GCAS® Desktop
Manual Guide

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Revision Log

Revision : 14
Finalised on : 12 October 2015
Based on : GCAS Desktop version 1.8.1.0

- Updated chapter 21 (ISO 6976 trend comparison)
- Inserted chapter 17.3.7 (Send to ISO 6976 trend comparison)
- Updated screenshots for few other chapters

Revision : 13
Finalised on : 17 September 2015
Based on : GCAS Desktop version 1.8.0.0

- Updated chapter 20 (ISO 6976 trend)
- Updated chapter 15 (Comments)

Revision : 12
Finalised on : 26 August 2015
Based on : GCAS Desktop version 1.7.4.0

- Updated screenshots
- Renumbered chapter 27 to 31 (GCAS startup parameters)
- Renumbered chapter 26 to 30 (Diagnostics and maintenance)
- Renumbered chapter 25 to 29 (Working offline)
- Renumbered chapter 24 to 28 (Export data)
- Renumbered chapter 23 to 27 (Administrator menu)
- Renumbered chapter 22 to 25 (Data capture)
- Renumbered chapter 21 to 24 (Device management)
- Renumbered chapter 17 to 18 (Correlation calculator)
- Renumbered chapter 16 to 17 (Mole composition comparison)
- Renumbered chatper 15 to 16 (Dashboard)
- Renumbered chapter 14 to 15 (Comments)
- Updated chapter 1-13 in regard to ISO 10723 support
- Chapter 14 (Uncertainty trend comparison) is reserved for future updates
- Updated chapter 19 (ISO 6976 calculator)
- Chapter 20 (ISO 6976 trend) and 21 (ISO 6976 trend comparison) are reserved for future updates
- Inserted chapter 22 (ISO 10723)
- Updated chapter 23 (Lag time)
- Chapter 26 (Report) is reserved for future updates
- Removed chapter 30.2 (Bug report wizard)

Revision : 11
Finalised on : 22 December 2014
Based on : GCAS Desktop version 1.4.5.0

- Updated screenshots
- Inserted chapter 13 (Uncertainty trend)
- Complete rewrite on chapter 16 (Mole composition comparison)
- Updated chapter 11 (Uncertainty calculation)
- Updated chapter 27 (GCAS startup parameters)
- Minor update on chapter 1.4

Revision : 10
Finalised on : 5 November 2014
Based on : GCAS Desktop version 1.3.4.0

- Updated screenshots
- Updated chapter 12 (Uncertainty coefficients)
- Updated chapter 23 (Export data)
- Updated chapter 24 (Work offline, minor changes)

Revision : 9
Finalised on : 30 October 2014
Based on : GCAS Desktop version 1.3.3.0

- Inserted subchapter 8.8
- Inserted subchapter 9.7
- Updated chapter 14 (Dashboard)
- Updated chapter 17 (ISO 6976 calculator)
- Minor updates on chapter 1.4

Revision : 8
Finalised on : 13 October 2014
Based on : GCAS Desktop version 1.3.1.0

- Updated chapter 11 (Uncertainty calculation)
- Updated screenshots

Revision : 7
Finalised on : 6 October 2014
Based on : GCAS Desktop version 1.3.0.0

- Major changes in chapter 8 (inserted subchapter 8.5)
- Updated chapter 12 (Uncertainty coefficients)
- Major changes in chapter 20 (*Agreements and Devices* becomes *Device Management*)
- Major changes in chapter 21 (Data capture)
- Updated screenshots

Revision : 6
Finalised on : 20 August 2014
Based on : GCAS Desktop version 1.2.0.0

- Inserted chapter 11 (Uncertainty calculation), Mole composition comparison becomes chapter 15.
- Reserved chapter 12 (Uncertainty coefficients) for future release
- 'Comments' is moved to chapter 13
- Inserted chapter 14 (Dashboard)
- Updated chapter 'Correlation calculator', formerly chapter 13, now moved to chapter 16
- Reserved chapter 17 (ISO 6976 calculator) for future release
- Reserved chapter 18 (Lag time calculator) for future release
- Reserved chapter 19 for future release, possibly for AGA-8 calculator
- 'Agreements and devices' is moved to chapter 20, and all previous chapters afterwards are moved to chapter 21 onwards.

Revision : 5
Finalised on : 30 June 2014
Based on : GCAS Desktop version 1.1.0.1

- Updated GCAS Desktop system requirements
- Added chapter 1.4.4 (Instant trial)
- Updated chapter 7.4.3 (Manual entry)
- Inserted chapter 11 (Mole composition comparison)
- Reserverd chapter 13 (Correlation calculator)
- Updated chapter 15.1.5 (What if my GC device…)
- Updated chapter 18.9 (Conflict resolution)
- Minor updates for contents here and there
- Updated screenshots

Revision : 4
Finalised on : 6 June 2014
Based on : GCAS Desktop version 1.0.4.114

- Skipped revision 3 because revision 3 is only available in the HTML version of manual guide;
- Included support for Daniel C9+ and C10+ GCs.
- Updated chapter 4, 6, 7, 8, 10, 11, 12, 13, and 18
- Updated screenshots.

Revision : 2
Finalised on : 29 April 2014
Based on : GCAS Desktop version 1.0.2.37

- Added chapter 1.3 (Supported GC brands),
- Added chapter 8 (Mole composition),
- Included support for ABB GCs,
- Updated chapter 10, 12, and 18,
- Reserved chapter 9 (Lag time calculator),
- Corrections on chapter 14.3 (Manage groups),
- Expanded chapter 17 into 17.1 (Diagnostic mode) and 17.2 (Bug report wizard),
- Updated screenshots,
- Corrections on grammar and spelling errors.

Revision : 1
Finalsed on : 20 February 2014
Based on : GCAS Desktop version 1.0.0.1

- First release.

1 Welcome

Thank you for choosing GCAS® Desktop as a companion for your gas chromatograph devices. These help files provide guides about GCAS Desktop operation.

1.1 What GCAS is

GCAS® (Gas Chromatography Analysis Software) is a software tool specifically designed for GC (Gas chromatograph) conditional-based monitoring. The main purposes of the monitoring method embedded in the software are:

1. To analyse instantaneous GC data to see if it is working properly,
2. To provide and analyse historical data in order to identify changes and predict failures,
3. To support extended reproducibility tests so that the GC uncertainty may be determined.

GCAS comes in two versions, GCAS Web and GCAS Desktop. GCAS Web is available for customers using i-Vigilant central database. Both share the same database, so that you can log in to either version and see the same data. GCAS Web is being phased out, therefore i-Vigilant Technologies encourages all customers to move onto GCAS Desktop.

1.2 System Requirements

GCAS® Desktop requires:

1) Microsoft® Windows® Vista, Windows 7, Windows 8, Windows 8.1, or Windows 10. Also please note that Windows XP is no longer supported. We had one case GCAS Desktop did not run correctly on XP.
2) Microsoft .NET Framework 4.0. This is available from http://www.microsoft.com/en-us/download/details.aspx?id=17718. *Windows 8.1 and 10 have included .NET Framework 4 (even 4.5) therefore no need to install .NET Framework unless the setup package tells you*.
3) Microsoft SQL Server Compact Edition (CE) version 4.0. This is available from http://www.microsoft.com/en-us/download/details.aspx?id=17876.
4) Microsoft Visual C++ 2010 Runtime redistributable x86. This is available from http://www.microsoft.com/en-us/download/details.aspx?id=5555.
5) Internet connection, preferred.
6) 1280 x 720 screen resolution.
7) If you need to work with Microsoft Access databases or to export data to Microsoft Access database: You would need a separate licence of Microsoft Office or Microsoft Access 2010/2013, or either the **free** Microsoft Access Database Engine 2010 or **free** Microsoft Access Runtime 2013. Get Microsoft Access Database Engine 2010 from http://www.microsoft.com/en-us/download/details.aspx?id=13255 or Microsoft Access Runtime 2013 from http://www.microsoft.com/en-us/download/details.aspx?id=39358.

1.3 Supported GC Brands

GCAS Desktop is compatible with gas chromatograph devices which use **thermoconductivity detector** (TCD) and use **peak area** formula to calculate response factor.

For the time being, GCAS Desktop supports gas chromatograph manufactured by **Daniel Industries** and **ABB**. GCAS Desktop is able to import files generated by these brands. We plan to broaden this list in the future.

If your GC device is neither Daniel nor ABB, consult our support team to find a workaround. For instance, if your GC works in a similar manner as Daniel GCs only with slight differences, you can still designate the device as Daniel GC in GCAS Desktop but the interpretation of the charts will be different. As long as the device follows Modbus standard, automatic data capture should work without problems.

1.4 GCAS Licence and Activation

GCAS Desktop requires a valid *GCAS licence* to run. GCAS licence carries the information required such as what features are available to you, how many number of GC devices you can use, and the expiry date.

Current version of GCAS operates a GCAS licence version 3. GCAS licence version 1 was used for development purposes and is now obsolete. GCAS licence version 2 was used by beta (test) version of GCAS Desktop. Although current GCAS Desktop can read GCAS licence version 2, some features will be unavailable and we strongly recommend users of licence version 2 to upgrade their licences into version 3.

Customers can select which *GCAS features* to include in order to suit their need. The features are listed here:

- Modules
  - **Basic features** (always included) – Analysis parameter, Footprint, Calibration data, and Comments.
  - **Data Analysis**
  - **Live Data Analysis**
  - **Data Comparison**
  - **Calibration Gas Certificate**
  - **Uncertainty Calculation** (automatically unlocks calibration gas certificate module)
  - **Uncertainty Trend** (automatically unlocks calibration gas certificate module too)
  - **ISO 6976 Calculator**
  - **ISO 6976 Trend**
  - **ISO 10723**
  - **Lag Time Calculator**
- Device communication

        - **Modbus® over Serial**
        - **Modbus® over TCP**
    - Data import
        - **Text Import** (for Daniel or ABB GCs)
        - **CSV Import**
        - **Manual Data Entry** (always included)
    - Data export
        - **Export to CSV**
        - **Export to Microsoft SQL Server Compact Edition**
        - **Export to Microsoft Office**
    - Databases
        - **i-Vigilant Central Database**
        - **Local Corporate Database**
        - **Local Offline Database** (always included)
        - **Work-offline Capability**

Our website offers three packages of GCAS Desktop: basic, advanced, and comprehensive. Features included in each package are listed in this table.

Features	GCAS Basic	GCAS Advanced	GCAS Comprehensive
Modules			
Basic features	✓	✓	✓
Data Analysis		✓	✓
Live Data Analysis		✓	✓
Calibration Gas Certificate		✓	✓
Uncertainty Calculation		✓	✓
Uncertainty Trend		✓	✓
ISO 6976 Calculator		✓	✓
ISO 6976 Trend			✓
ISO 10723		✓	✓
Lag Time Calculator		✓	✓
Communication			
Modbus® over Serial			✓
Modbus® over TCP			✓
Data import			
Text import		✓	✓
CSV import		✓	✓
Manual Data Entry	✓	✓	✓
Data export			
Export to CSV		✓	✓
Export to Microsoft SQL Server CE		✓	✓
Export to Microsoft Office		✓	✓
Databases			
i-Vigilant Central Database	✓	✓	✓

Local Corporate Database		✓	✓
Local Offline Database	✓	✓	✓
Work-Offline Capability		✓	✓

Users buying GCAS basic package or GCAS advanced package have options to purchase *add-on* features *à la carte* which are appended to their licences. Visit our website for pricing information of each feature. Users buying GCAS comprehensive package have no more add-ons available as they already get access to all GCAS features.

1.4.1 Types of Licence

There are two types of GCAS licence: Lifetime and Subscription.

Lifetime licences or perpetual licences are GCAS licences that never expire. Lifetime licences are intended for customers who purchased retail copies of GCAS Desktop, i.e. one-off purchases.

On the contrary, **subscription licences** are licences that renew periodically. They are intended for customers with subscription plan. Depending on customer preference, renewal period can be monthly, quarterly, semester, annual, or biannual. Customer with subscription licence should check for licence update periodically or leave the automatic licence update on, in order to ensure continuous access to GCAS Desktop.

Trial licence is a subtype of subscription-based licence for new and prospective customers. Depending on customer request, i-Vigilant Technologies Limited issues trial licences which typically last between one to three months. Usually, trial licences carry *all* GCAS features with a limited maximum number of GC devices. Within their trial period, customers can upgrade their licences to standard subscription licence with select GCAS features and enough number of GCs to suit their needs.

Instant trial licence is more specific type of trial licence. This licence is issued only once per computer and only valid for 4-day trial. An instant trial licence is upgradable to a regular trial licence (see the previous paragraph) which later on, still upgradable again to a full licence. Read more about instant trial.

1.4.2 How Many PCs?

When you purchase GCAS Desktop from i-Vigilant's website, the website asks for information such as the package you want, any feature add-on packs, how many GCs and how many PCs. We generate your licence based on this information thus your licence is ready when you go through online activation process.

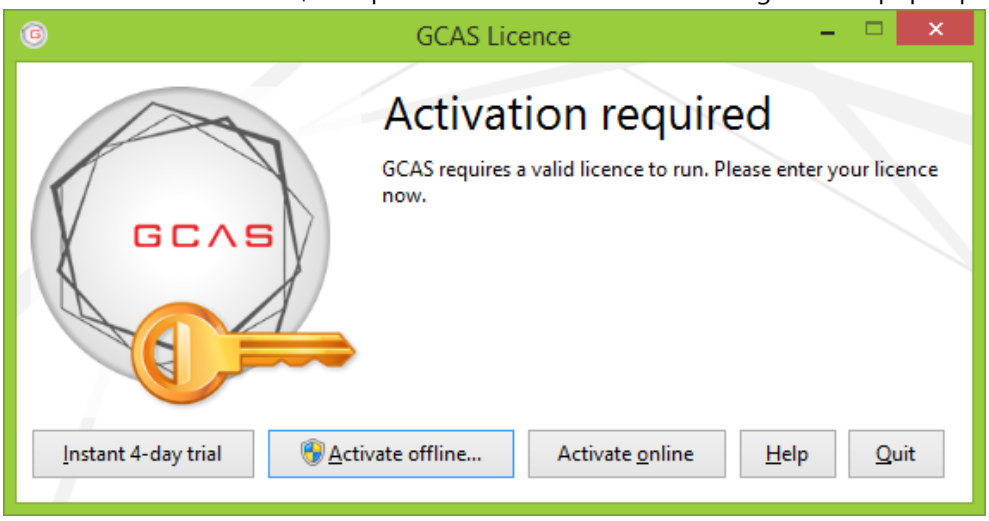
Currently our website offers 1, 3, or 5 computers. Contact us if you need more than 5 computers so we can arrange a discount for you. This number of PC becomes the **activation count**. One successful online activation will reduce this number by one. If you don't have internet access and request offline activation by sending your computer code, we will send your licence via email then we will also

decrease your activation count by one. When this activation count reaches zero, you have used up all your available licences and cannot activate GCAS Desktop on other PCs.

1.4.3 Online Activation

If your computer has a working internet connection, we advise to activate your GCAS online. During online activation, GCAS Desktop contacts GCAS Activation Server maintained by i-Vigilant Technologies to retrieve your licence.

1. The first time GCAS is run, it requests for activation. The following window pops up.

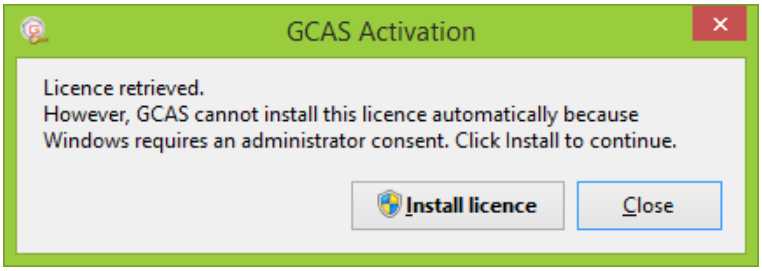


2. Online activation requires internet connection.
3. Click **Activate online** button and you shall see this window:

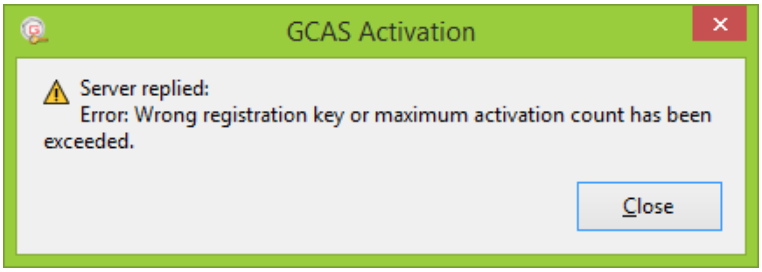


4. **Registration name** is your customer identifier name as you have entered during checkout process on our website. For offline purchase, we will send your registration name. This name is case sensitive, requires exact spelling.
5. **Registration key** is six numeric digit and doesn't start with zero. This key is available on the confirmation page and my account page (for online purchase) or in our confirmation email (for offline purchase).

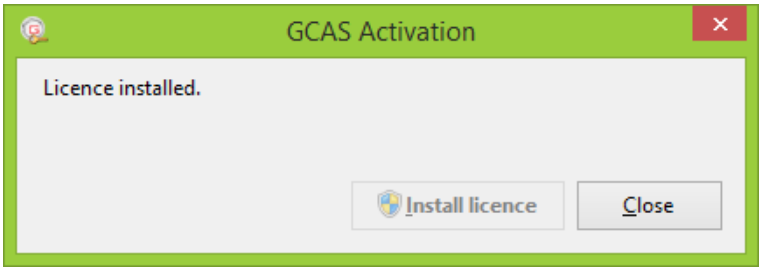
6. *If you purchased GCAS Desktop through an offline channel such as PO or direct meeting:*
   Tell us your **computer code** either by email, fax, or phone. Our email address is support@i-Vigilant.com. Wait for our confirmation that we have successfully generated your licence.
7. *If you purchased GCAS Desktop through our website:*
   You don't have to tell your computer code because your licence is generated automatically at the time of first activation. As long as you entered correct registration name and key (case sensitive) and you haven't exceeded your activation count, licence generation will work without problems.
8. Type your registration name and registration key, then click ➔ **Activate**. Provided that all data were correct, this window will show.


GCAS Activation
Licence retrieved.
However, GCAS cannot install this licence automatically because Windows requires an administrator consent. Click Install to continue.
Install licence
Close

   Otherwise you see an error message similar to this one.



9. Click **Install licence**. If UAC is enabled on your computer, and it is usually enabled by default, a UAC prompt may appear. If you are the computer administrator, click **Yes** to continue. Otherwise ask your computer administrator to type in the admin password.
10. The following window confirms that your licence and registration key have been installed on your computer.

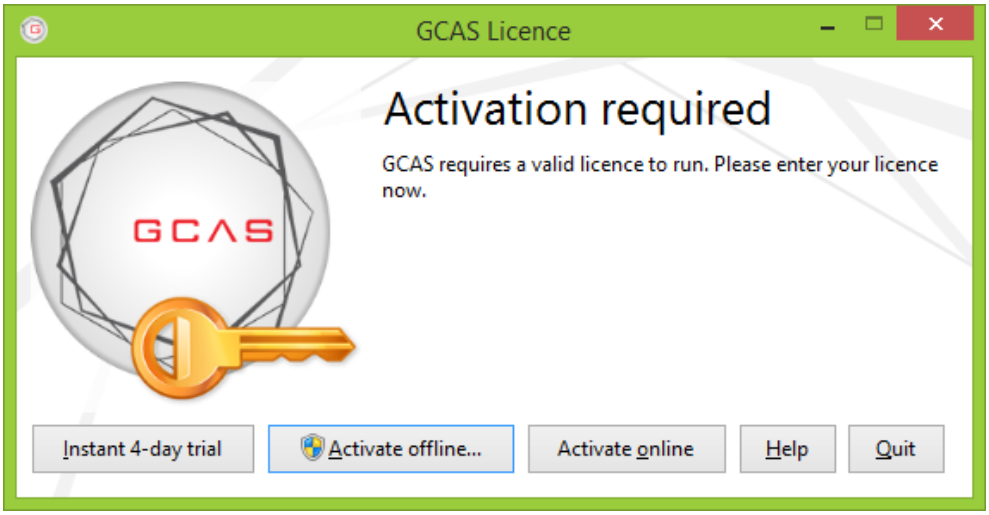


11. Click **Close** and now GCAS Desktop is activated, ready to use.
12. In rare cases where UAC is disabled possibly by your system administrator, the licence would be installed automatically without UAC prompt. This implies you wouldn't see the screen as depicted in step 8 and 10.

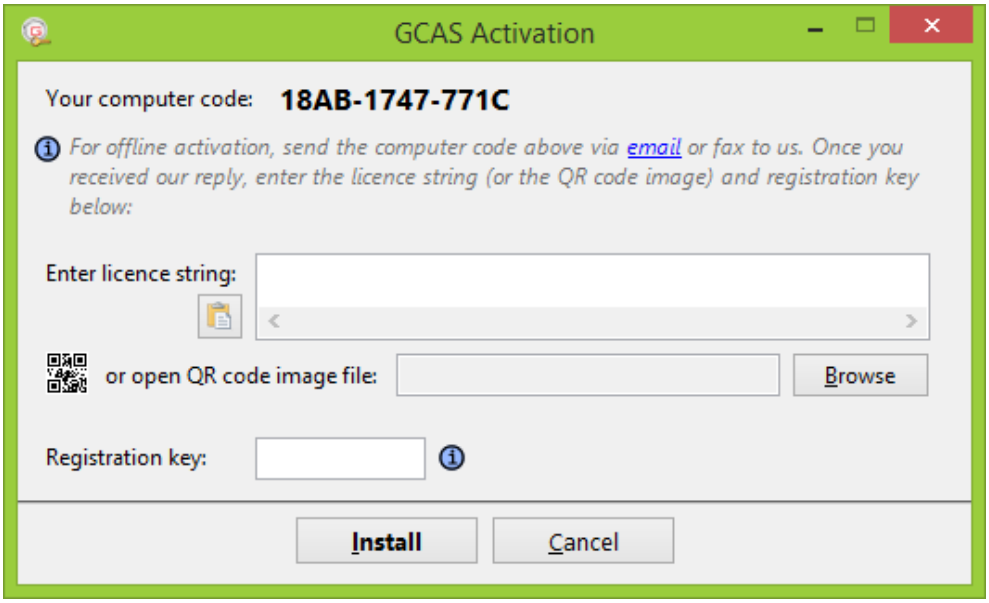
1.4.4 Offline Activation

For computers without internet connection e.g. on off-shore location or remote site, you can activate GCAS Desktop offline. You need your *licence string* (or QR code image file) together with your registration key stored offline such as in your corporate email or in a USB flash drive.

1. The first time GCAS Desktop is run, it requests for activation. The following window pops up.



2. Offline activation does not require internet connection.
3. Click **Activate offline**. UAC prompt may appear.
4. *GCAS Activator* window is displayed.


GCAS Activation
Your computer code: 18AB-1747-771C
For offline activation, send the computer code above via email or fax to us. Once you received our reply, enter the licence string (or the QR code image) and registration key below:
Enter licence string:
or open QR code image file:
Browse
Registration key:
Install
Cancel

5. Tell us your **computer code** via email to support@i-vigilant.com or via fax. We need this code to generate your licence. After we generate your *licence string*, we will reduce your activation count by one (1) accordingly.
6. Once you have received our reply, either enter the licence string or load the QR code image. Then enter the registration key as well.
7. *Licence string* is a long encoded text which looks similar to this.

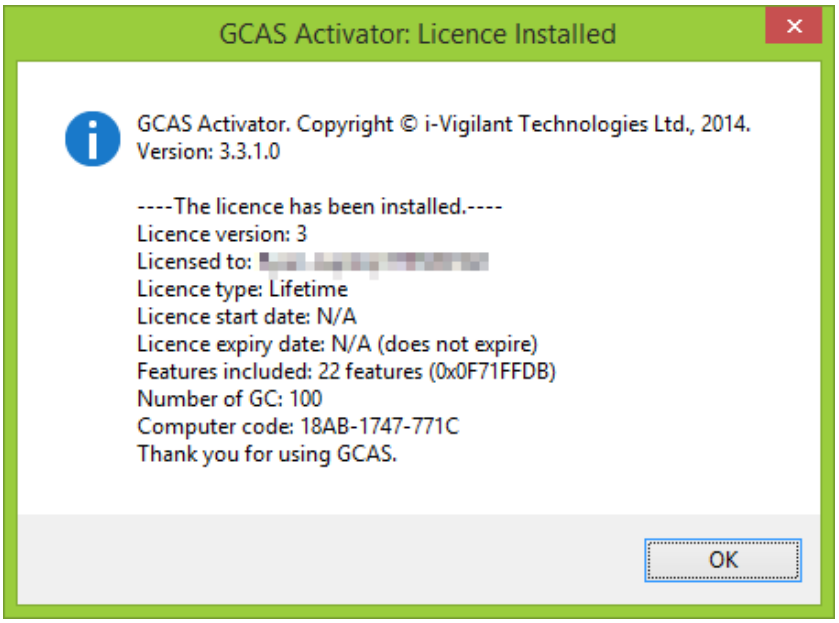
```
zZPgHRyhHRqMsZijmaukdJaWlaqhpZulp4SuroCR76Oum6KXoqiZmJ3mkaC1eZq2qpidn6eOp4WY
l4GYrYukuHmnl6KutqqupKqKqZyU3e/brLWklouss5qgspajqoGTkRSEqea6ie6GqqqRnL92obiIqamk
vaKsoLSsjaCegaKnrKigpaV7uA==
```

8. QR code image file looks like the following.



This is a standard QR code image that contains the licence string itself. You can use your smartphone or any QR code scanner to verify its content.

9. Click **Install** on GCAS Activator form.
10. The following message box confirms that your licence and registration key have been successfully installed. On some Windows versions, this message is displayed in a command prompt window instead of a message box.


GCAS Activator: Licence Installed
GCAS Activator. Copyright © i-Vigilant Technologies Ltd., 2014.
Version: 3.3.1.0
----The licence has been installed.----
Licence version: 3
Licensed to:
Licence type: Lifetime
Licence start date: N/A
Licence expiry date: N/A (does not expire)
Features included: 22 features (0x0F71FFDB)
Number of GC: 100
Computer code: 18AB-1747-771C
Thank you for using GCAS.
OK

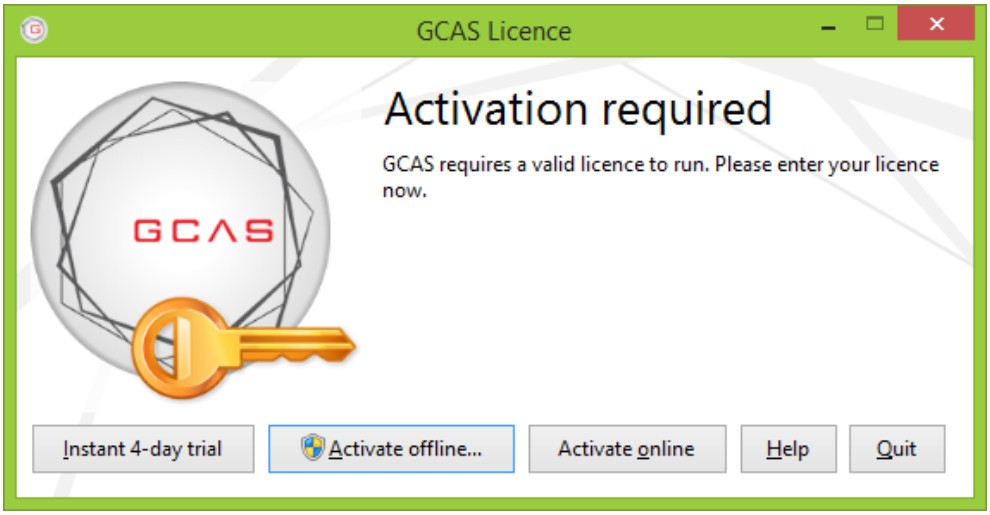
11. Click **OK** and GCAS Desktop is activated, ready to use.

1.4.5 Instant Trial

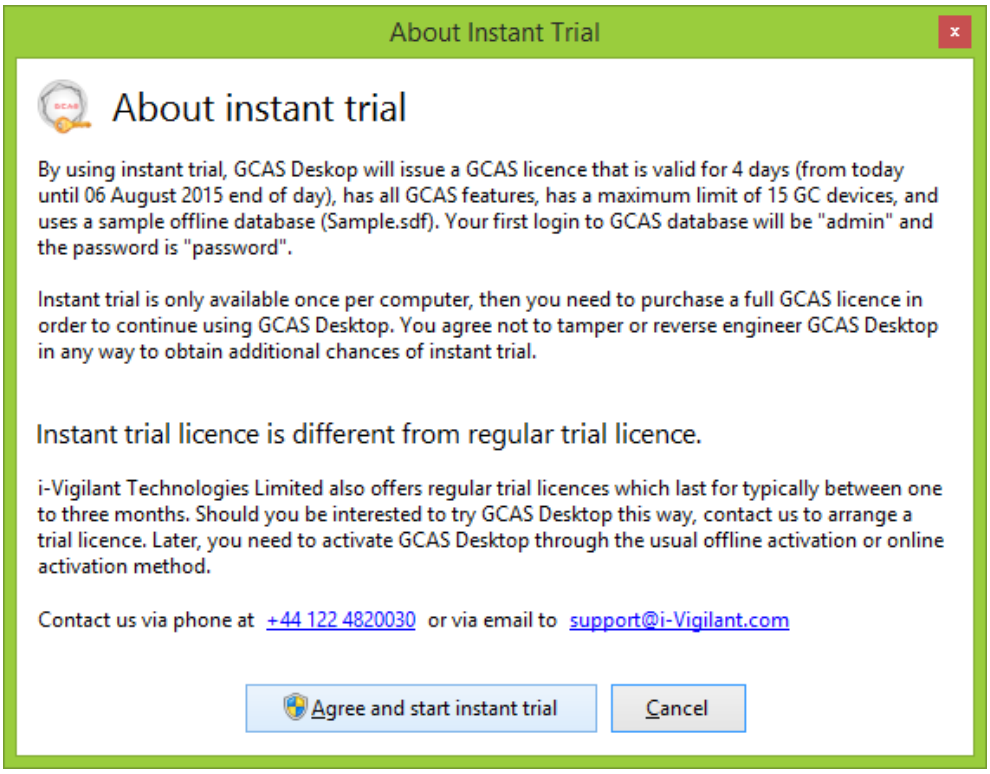
Instant trial is offered to new and prospective customers to try GCAS Desktop quickly without the hassle of sending your computer code and waiting for your licence in our reply and for us to set up a database for you. Unlike "regular" trial licences, instant trial licence is only valid for **4 (four) days**, including the day you started the instant trial. After your trial period expires, GCAS Desktop will stop

working. You can then request for an extended trial or purchase a full licence altogether. Contact us to get an arrangement.

To try GCAS Desktop using instant trial, click **Instant 4-day trial** on this window.



Read the information presented in the oncoming window. If you agree, click **Agree and start instant trial**.


About Instant Trial
About instant trial
By using instant trial, GCAS Deskop will issue a GCAS licence that is valid for 4 days (from today until 06 August 2015 end of day), has all GCAS features, has a maximum limit of 15 GC devices, and uses a sample offline database (Sample.sdf). Your first login to GCAS database will be "admin" and the password is "password".
Instant trial is only available once per computer, then you need to purchase a full GCAS licence in order to continue using GCAS Desktop. You agree not to tamper or reverse engineer GCAS Desktop in any way to obtain additional chances of instant trial.
Instant trial licence is different from regular trial licence.
i-Vigilant Technologies Limited also offers regular trial licences which last for typically between one to three months. Should you be interested to try GCAS Desktop this way, contact us to arrange a trial licence. Later, you need to activate GCAS Desktop through the usual offline activation or online activation method.
Contact us via phone at +44 122 4820030 or via email to support@i-Vigilant.com
Agree and start instant trial
Cancel

Instant trial information window.

A UAC prompt may appear. If you are the computer administrator, click **Yes** to continue. Otherwise, ask an administrator to enter the required password.

If you cannot find the button, instant trial may not be available for you because probably you already used it before. Instant trial is only offered once per computer. For example, if a user tries to uninstall GCAS Desktop after his trial period is over and then reinstalls the software again, he will not see the **Instant 4-day trial** button a second time.

1.4.6 Automatic Licence Update

Licence update is an update for your licence. For example, a customer has subscription plan and they just extended their subscription for another month, the expiry date on their licence is then updated to the latest subscription end date. Another example, a customer decided to add more features to their licence. Their licence is updated to reflect this change.

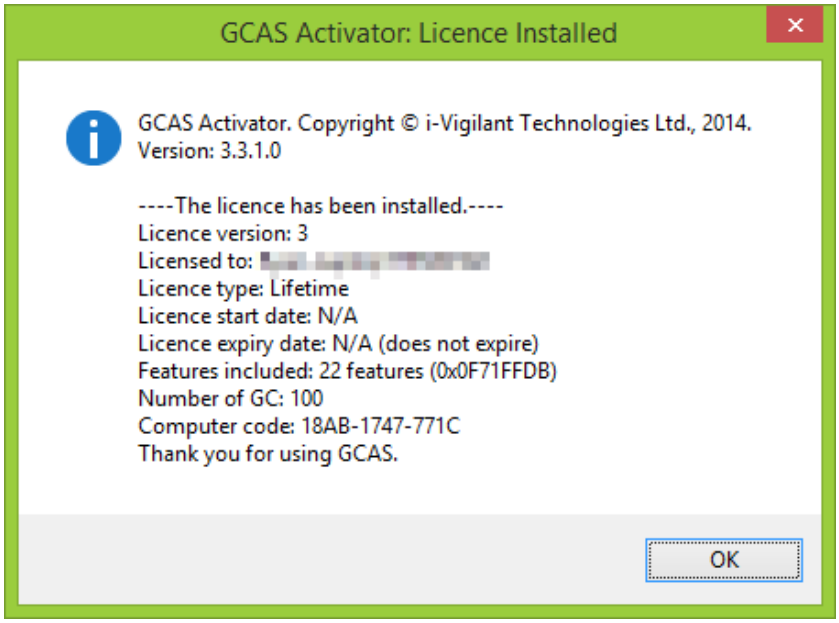
By default, GCAS checks for licence update in GCAS Activation Server once during launch, and once every 24 hours. *Automatic licence update works only if your computer has a working internet connection.*

1. If there is any update for the licence in GCAS Activation Server, a window similar to this one shall appear. The text on this notification window may vary depending on what kind of update is available for you (e.g. extension of expiry date, feature update, or limit upgrade on number of GC).


Licence Update Available
Your GCAS licence is being extended to 01 December 2016.
However GCAS cannot install this licence automatically because Windows requires an administrator consent. Click 'Install' to proceed.
Install
Dismiss

2. Click **Install**. It may trigger a UAC prompt. Click **Yes** on the UAC prompt or ask your computer administrator to type the required password. GCAS Desktop will update the licence and the

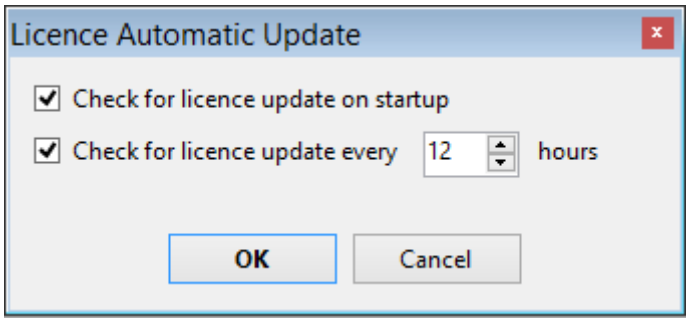
window similar to this one shall appear.


GCAS Activator: Licence Installed
GCAS Activator. Copyright © i-Vigilant Technologies Ltd., 2014.
Version: 3.3.1.0
----The licence has been installed.----
Licence version: 3
Licensed to:
Licence type: Lifetime
Licence start date: N/A
Licence expiry date: N/A (does not expire)
Features included: 22 features (0x0F71FFDB)
Number of GC: 100
Computer code: 18AB-1747-771C
Thank you for using GCAS.
OK

3. In rare cases where UAC is disabled by your system administrator, or if GCAS Desktop is running in elevated mode (run as administrator), the notification window will appear green instead of yellow. The licence is updated automatically and you don't have to click the Install button.


Licence Update Available
Your GCAS licence has been extended to 01 December 2016.
GCAS has successfully installed this new licence. Thank you for using GCAS.
Dismiss

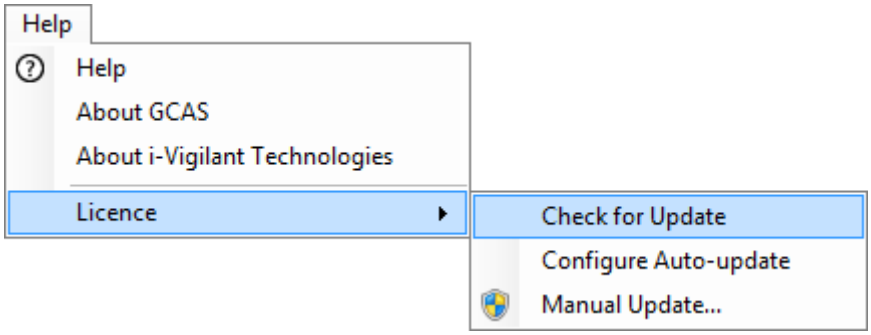
To configure how GCAS should check licence update automatically, go to the Help menu > Licence > **Configure Auto-update**.



1.4.7 Manual Licence Update

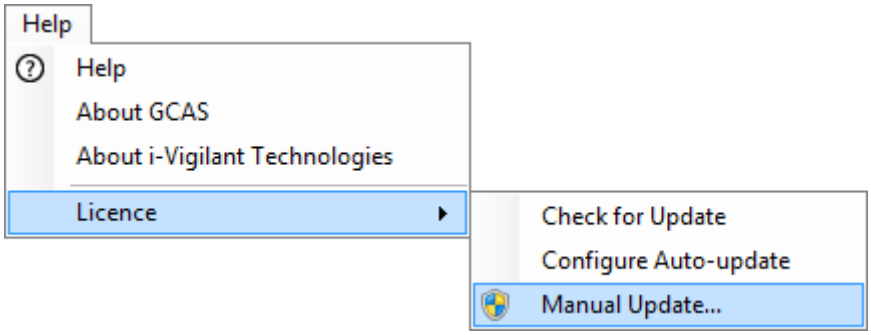
1.4.7.1 If you are online

You can force GCAS Desktop to check for licence update now. To do so, go to the Help menu > Licence > **Check for update**.

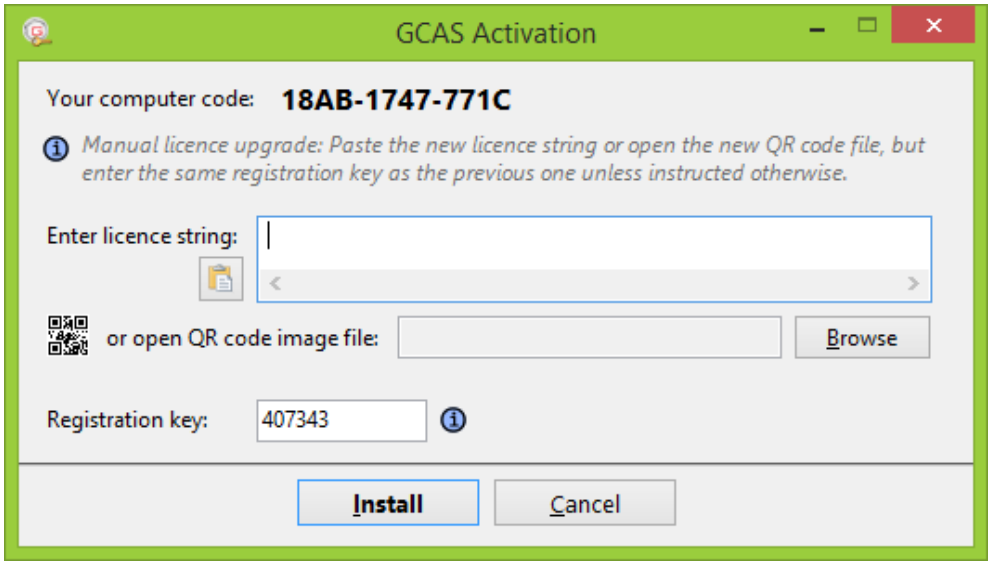


1.4.7.2 If you are offline

Should the computer had difficulties connecting to the internet e.g. on remote areas or off-shore sites, we will send you a new licence string and/or QR code. To install this new licence, go to the Help menu > Licence > **Manual Update**.



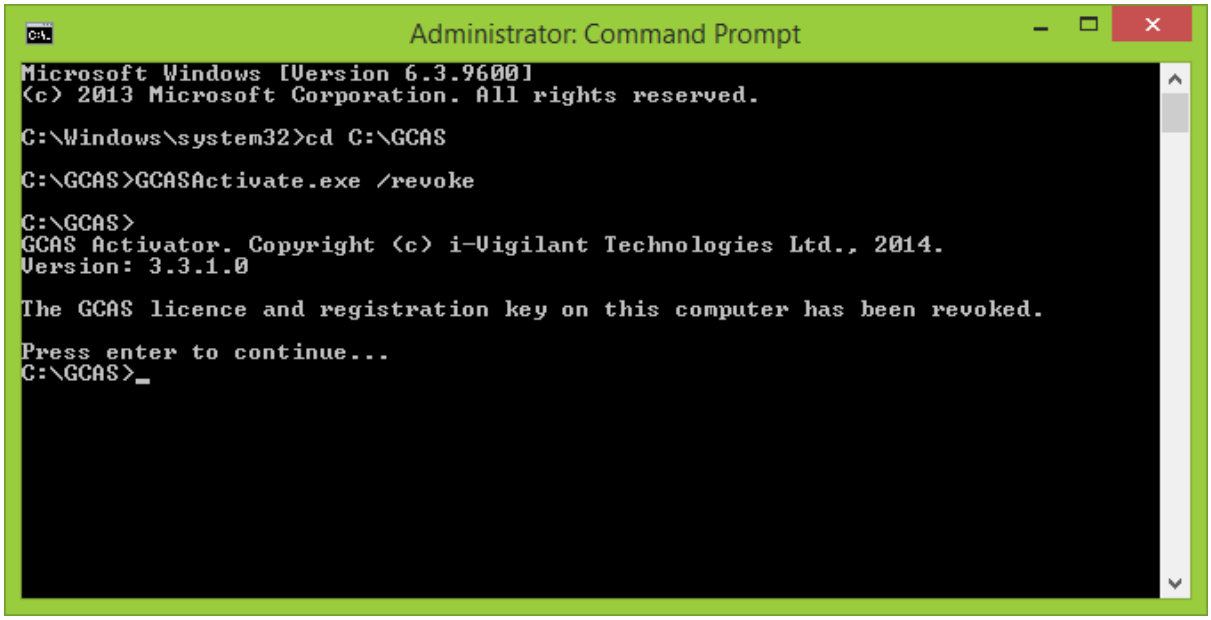
UAC prompt may appear. Afterwards, either enter the new licence string or open the new QR code, but re-enter the same registration key as the previous one. (The software automatically does this for you.) Click **Install** and GCAS Activator will replace the installed licence string with the new one.


GCAS Activation
Your computer code: 18AB-1747-771C
Manual licence upgrade: Paste the new licence string or open the new QR code file, but enter the same registration key as the previous one unless instructed otherwise.
Enter licence string:
or open QR code image file:
Browse
Registration key: 407343
Install
Cancel

1.4.8 Deactivation

To uninstall your licence and registration key, start an elevated command prompt (run as administrator) and then execute this command:

```
GCASActivate /revoke
```


Administrator: Command Prompt
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.
C:\Windows\system32>cd C:\GCAS
C:\GCAS>GCASActivate.exe /revoke
C:\GCAS>
GCAS Activator. Copyright (c) i-Vigilant Technologies Ltd., 2014.
Version: 3.3.1.0
The GCAS licence and registration key on this computer has been revoked.
Press enter to continue...
C:\GCAS>

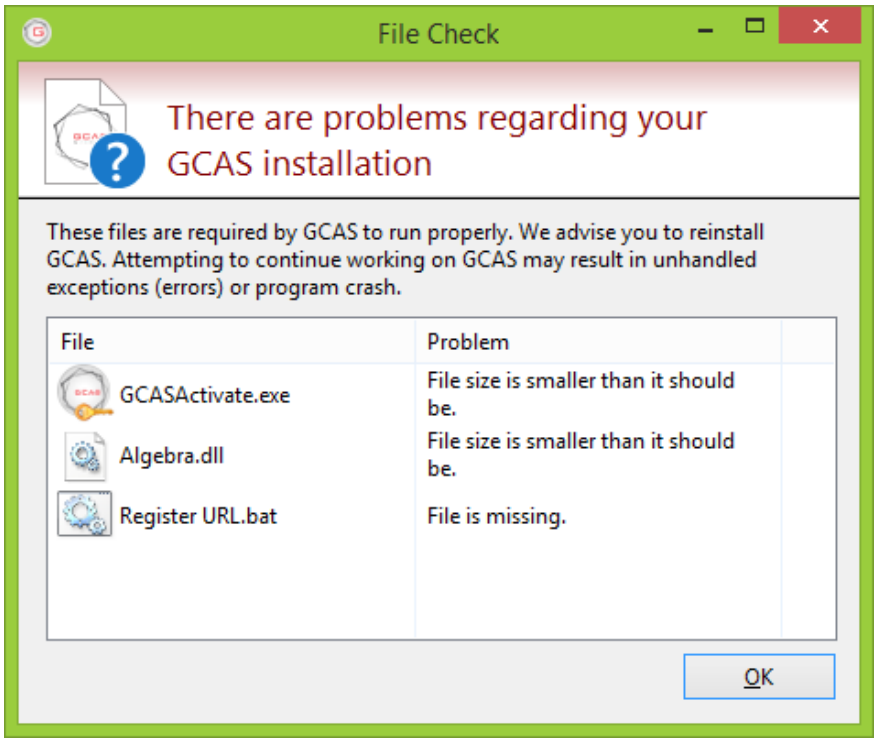
Note

Deactivation does not automatically increase your activation count. Contact us once the deactivation process is completed so we can raise your activation count by one (1), thus you can activate GCAS Desktop on another PC. *Please attach a screenshot of your command prompt window in your email.*

Instant trial users, do not deactivate your instant trial licence because instant trial licence is only offered once per computer—unless you have a full licence or extended trial licence available, or if you decided to uninstall GCAS Desktop.

1.5 Integrity Check

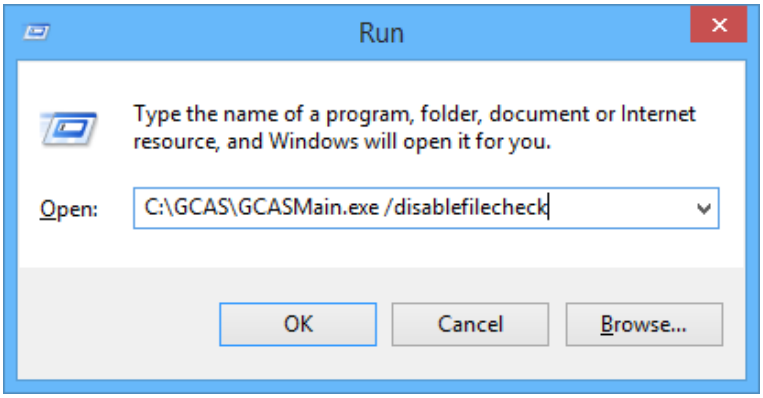
GCAS Desktop performs a check on the installation directory during start up in order to ensure that all required files are present and unmodified. When GCAS Desktop detects a file is missing or has an unauthorised changes, it presents a warning similar to this.


File Check
There are problems regarding your GCAS installation
These files are required by GCAS to run properly. We advise you to reinstall GCAS. Attempting to continue working on GCAS may result in unhandled exceptions (errors) or program crash.
File
Problem
GCASActivate.exe
File size is smaller than it should be.
Algebra.dll
File size is smaller than it should be.
Register URL.bat
File is missing.
OK

This notification does not prevent you from using GCAS; you could still dismiss the notification through **OK** button and log in to GCAS as usual. However, there is a higher risk of GCAS crashing at some point later. Especially when there is a .dll file missing, this will raise **`Dll Not Found Exception`** or **`File Not Found Exception`** error message later on.

If you see this warning every time you start GCAS Desktop, the first step to try is to reinstall GCAS Desktop. Have your registration key and your licence string or QR code ready in case you need to reactivate GCAS Desktop again.

Should the reinstall action provides no remedy to the problem, you can disable this feature by running GCAS Desktop with an additional **/disablefilecheck** parameter. You might want to modify the shortcut to GCAS Desktop to include this additional switch.


Run
Type the name of a program, folder, document or Internet resource, and Windows will open it for you.
Open:
C:\GCAS\GCASMain.exe /disablefilecheck
OK
Cancel
Browse...

2 Database

GCAS Web and GCAS Desktop reads and stores data into *GCAS database*. This chapter explains further about GCAS database.

2.1 Where Your Data is Stored

There are three different choices of data storage:

1. **i-Vigilant central database**
   Data is stored in database server(s) maintained by i-Vigilant Technologies. Customers using this database server can access it using both GCAS Web and GCAS Desktop. Using this server requires internet connection.
2. **Corporate database server**
   Also known as "local corporate database", your data is stored in a database server within your company local area network (LAN). Customer can access data on this database server using GCAS Desktop only.
3. **Local offline database**
   Data is stored in a file on your computer. This database is permanently offline, isolated from outside world. Customer can access data on this database server using GCAS Desktop only.

Each choice is a distinct GCAS feature in your GCAS licence. Customer with GCAS licence that only includes *i-Vigilant Central Database* and *Local Corporate Database* cannot use local offline database.

2.2 Supported DBMS

GCAS database is a relational database managed by a *Database Management Server* (DBMS). GCAS does not develop its own DBMS, but instead uses one of the following commercial DBMSes.

1. Local corporate database
   a. MySQL version 5 or later,
   b. Microsoft SQL Server 2008 (untested), 2012, or 2014.
2. Local offline database
   a. Microsoft SQL Server Compact Edition v4.0,
   b. Microsoft Access 2010/2013.

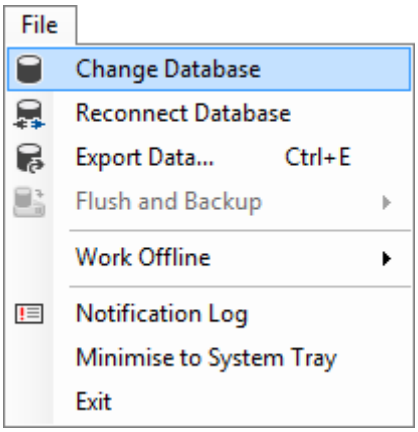
*Especially for Microsoft SQL Server 2014, you need to install updates for Microsoft .NET Framework 4 from Windows Update. Also Microsoft SQL Server 2016 is in technical preview version at the time this document is written, hence we do not recommend storing your precious data on a beta DBMS.

Should you have interest in setting up a local corporate GCAS database within your company network or using a local offline database for your company, contact our support team to arrange a deployment for you.

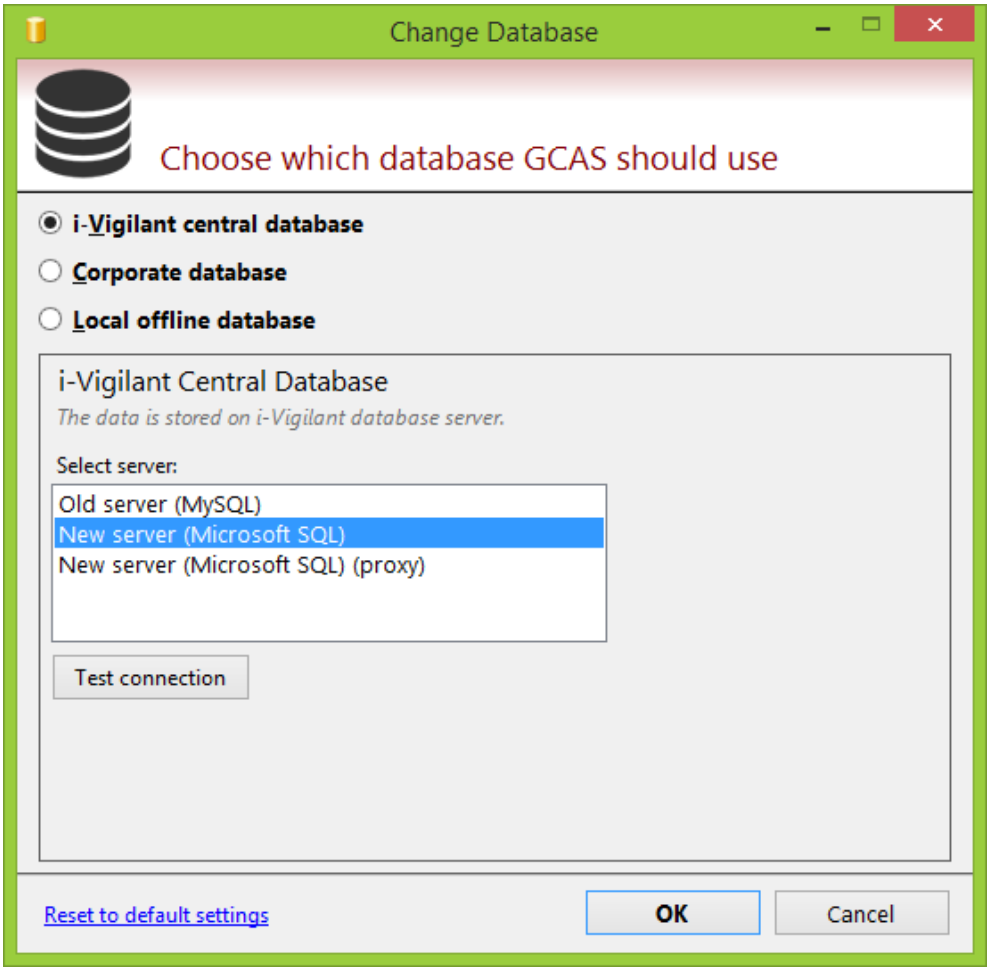
2.3 Change Database

Most users do not have to worry about changing database. But if your data is stored in two or more databases, tell GCAS Desktop which database it should connect to.

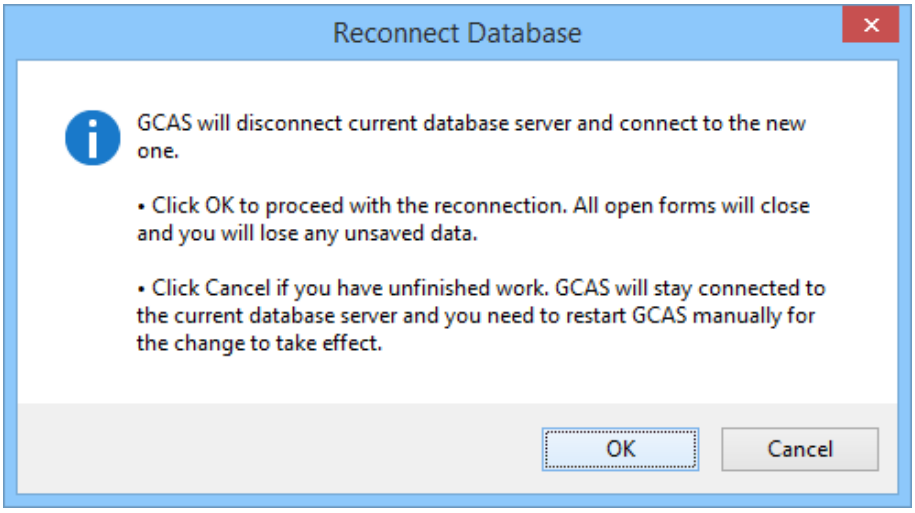
To switch database, make sure that no forms open on your work area and you are not working offline. Next, go to File menu > **Change Database**.



This menu will bring up the *Change Database* dialogue. Choose which database you would like to use whether i-Vigilant central database, your own corporate database, or an offline database file.



Enter the required parameters, e.g. IP address or server host name, DBMS username, and DBMS password. You can test whether the parameters are correct through **Test connection** button. Make sure you have your GCAS username and password registered in the desired GCAS database so you can log in to GCAS Desktop later. When you click **OK**, GCAS Desktop asks you whether to switch it now or later.

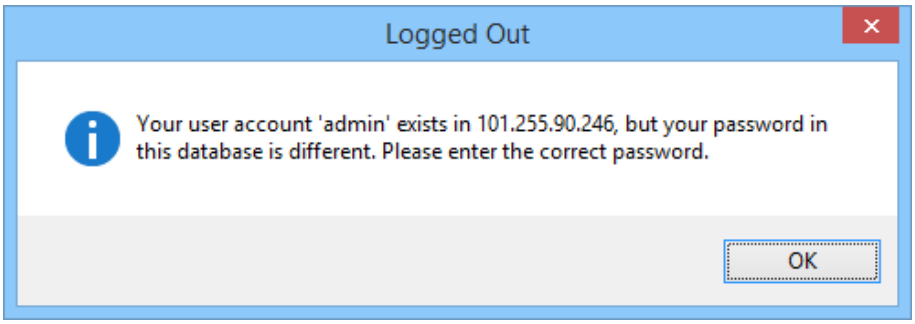

Reconnect Database
GCAS will disconnect current database server and connect to the new one.
• Click OK to proceed with the reconnection. All open forms will close and you will lose any unsaved data.
• Click Cancel if you have unfinished work. GCAS will stay connected to the current database server and you need to restart GCAS manually for the change to take effect.
OK
Cancel

If you click **OK**, GCAS Desktop will:

1. Unload all workspaces and devices from current database,
2. Disconnect from current database,
3. Connect to the new database, and finally
4. Load workspaces and devices from new database.

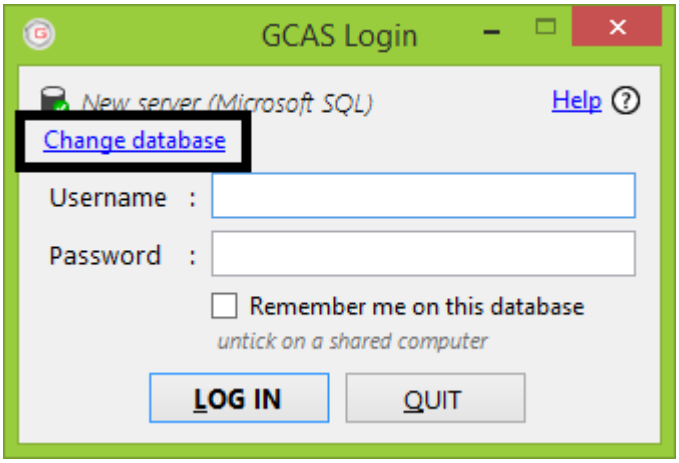
Otherwise if you click **Cancel**, GCAS Desktop keeps connection to current database until you exit the software.

You can resume working afterwards if your credential (username and password) is exactly the same in both databases. Otherwise, GCAS Desktop will log you out and you are prompted to log in again using the correct credential.

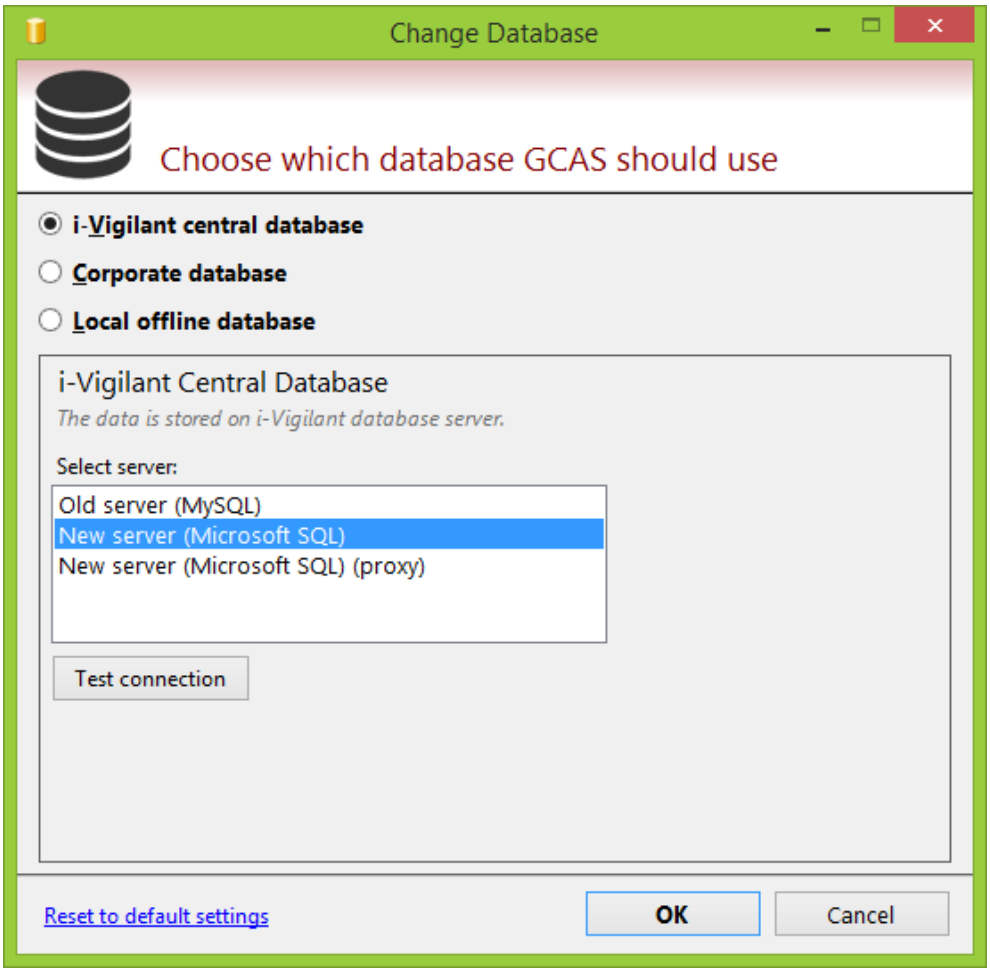

Logged Out
Your user account 'admin' exists in 101.255.90.246, but your password in this database is different. Please enter the correct password.
OK

2.4 Change Database before Login

Starting from GCAS Desktop 1.7.3.0, login window displays a link to change database. Find the link near the top left corner below the database name.

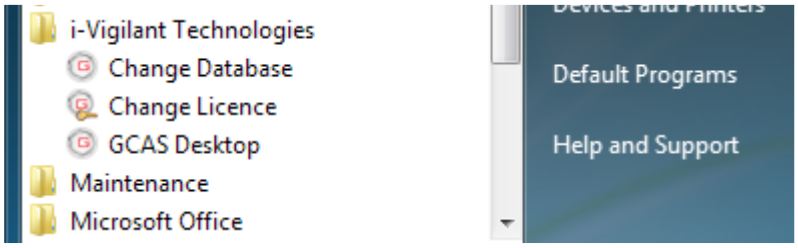


This link brings you to the same *Change Database* dialogue. Enter the required parameters e.g. IP address or server host name, DBMS username, and DBMS password. Click **OK** and GCAS Desktop will restart. After restart, you see the new database displayed on the top of login form.



2.5 Change Database without Running GCAS

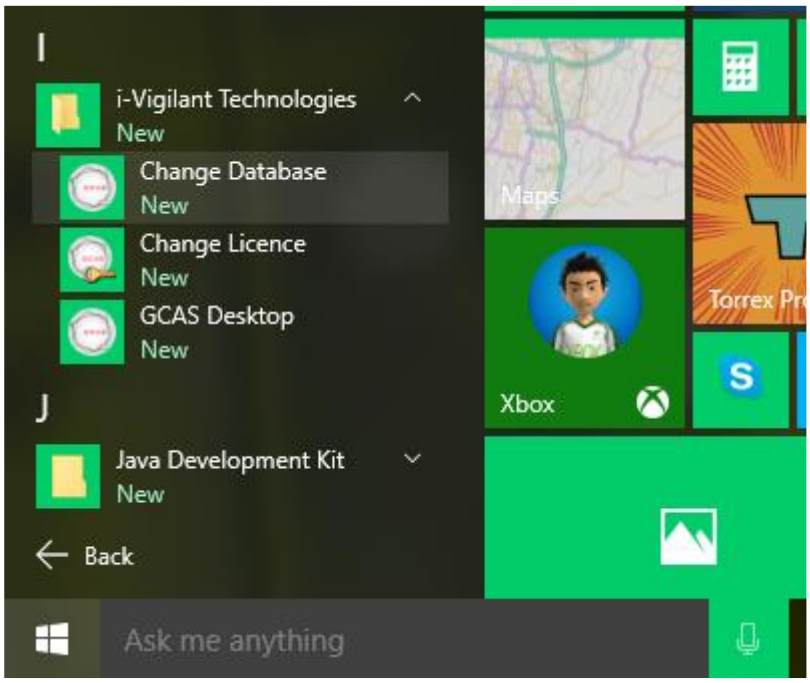
1. On Windows Vista or 7, open the Start menu then go to All Programs. Within *i-Vigilant Technologies*, click on the shortcut **Change Database**.



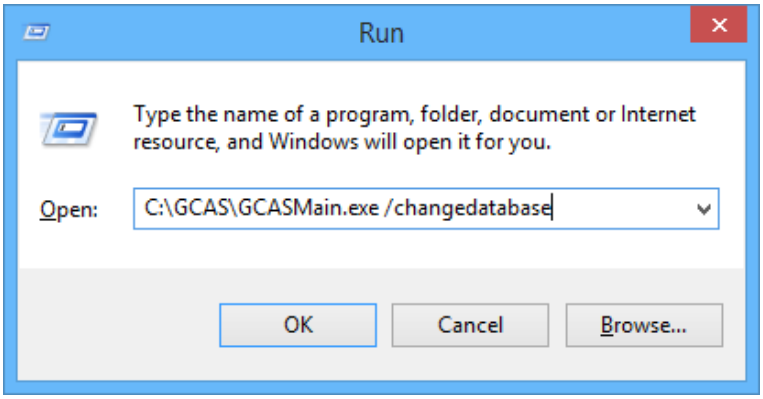
2. On Windows 8 or 8.1, open the Start screen. Change the view to All Apps view. Scroll to the right, find *i-Vigilant Technologies* and the same shortcut should be there.



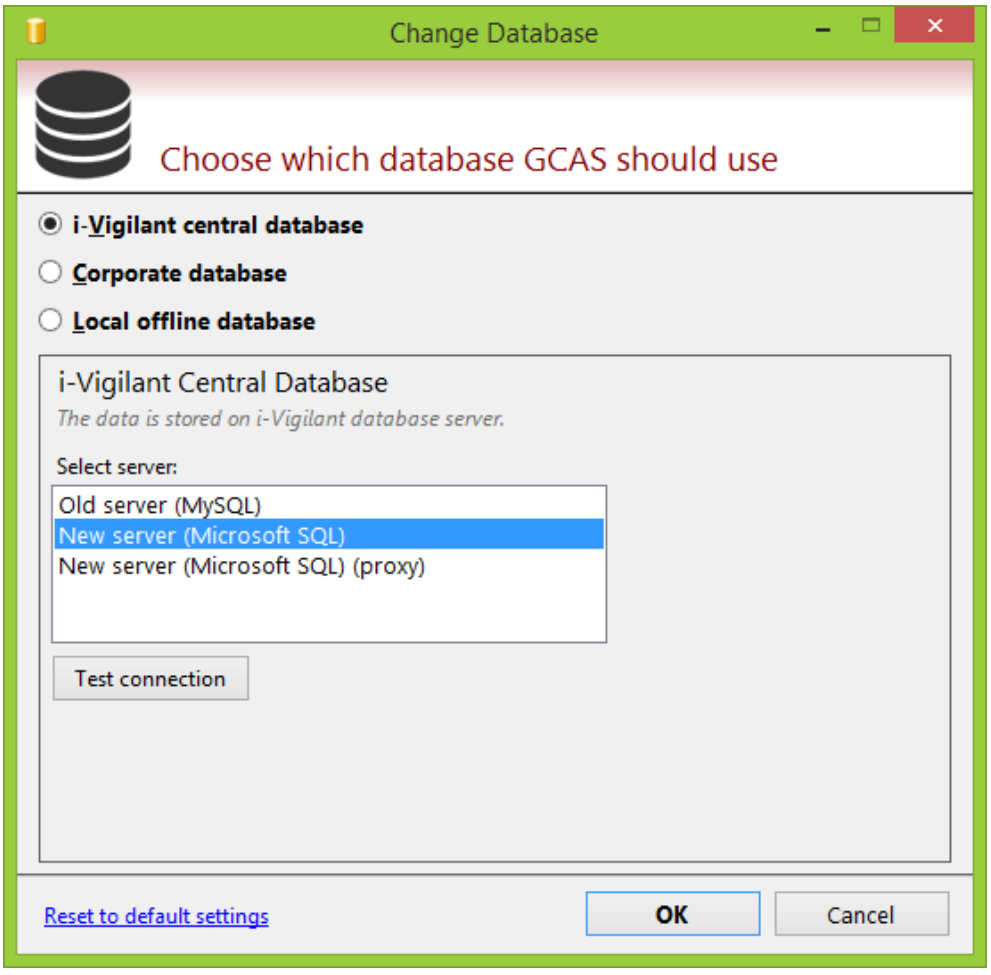
3. On Windows 10, open the Start menu (or Start screen if you are on tablet mode). Next, go to All Apps. Jump to the letter I then find *i-Vigilant Technologies*. Inside the folder you will find the **Change Database** shortcut.



4. Alternatively, run GCAS Desktop with additional **/changedatabase** parameter.



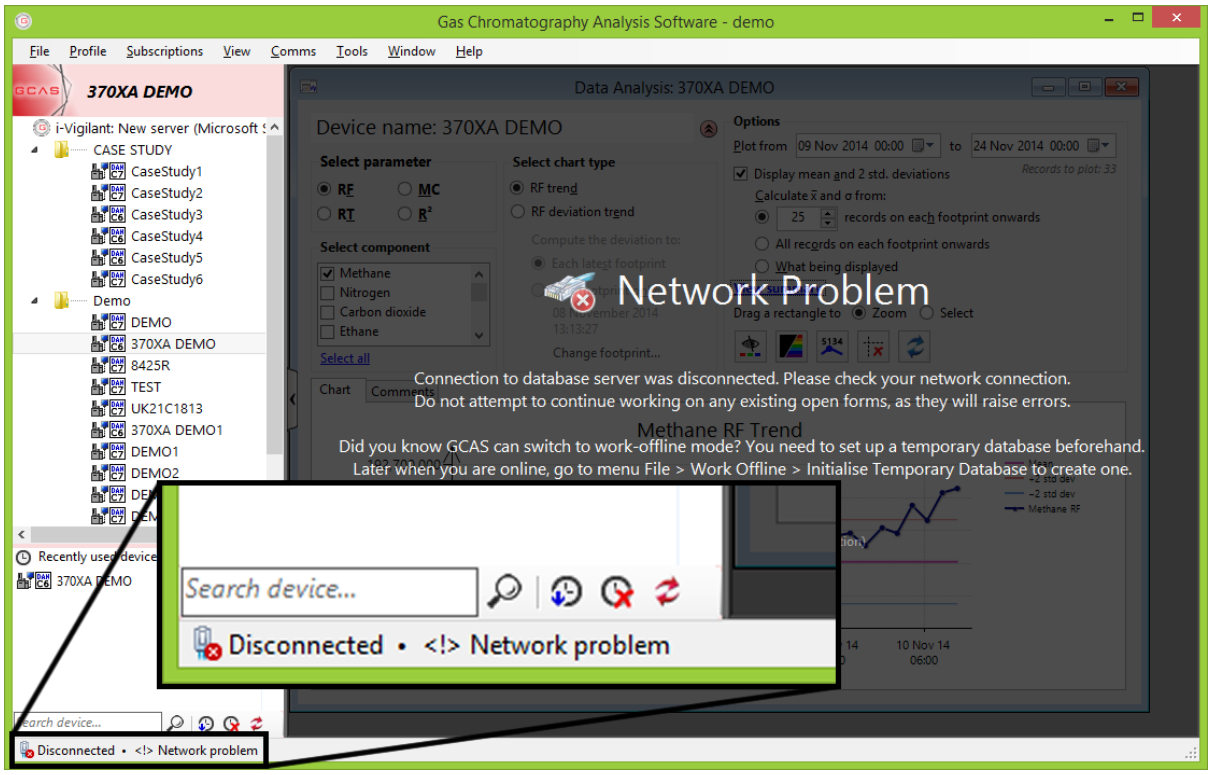
Any of the actions above would bypass the login screen straight to the *Change Database* dialogue. On this dialogue box, select the desired database server.



Click **OK** and start GCAS Desktop again.

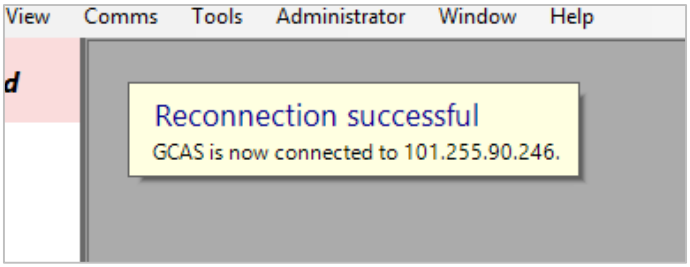
2.6 Reconnect on Network Problem

If you were disconnected from GCAS database server because of network problem*, GCAS Desktop displays an overlay notification and the status bar reads `Network Problem`. Click anywhere on the overlay to dismiss the notification.


Gas Chromatography Analysis Software - demo
File Profile Subscriptions View Comms Tools Window Help
370XA DEMO
Data Analysis: 370XA DEMO
Device name: 370XA DEMO
Network Problem
Connection to database server was disconnected. Please check your network connection.
Do not attempt to continue working on any existing open forms, as they will raise errors.
Did you know GCAS can switch to work-offline mode? You need to set up a temporary database beforehand.
Later when you are online, go to menu File > Work Offline > Initialise Temporary Database to create one.
Search device...
Disconnected • <!> Network problem

(*because of network problem and you do not have work-offline capability included in your licence, or you *do* have one but you've never set up a temporary database before)

Wait for network connectivity to recover and then go to the File menu > **Reconnect Database** in order to reconnect. If the reconnection attempt is successful, GCAS Desktop displays a tooltip notification while all workspaces and devices are reloaded. Please close and reopen all windows and dialogues that were opened before network disconnection.



2.7 Temporary Database

Temporary database is a subset of whole GCAS database. This kind of database is used by work-offline feature, on which GCAS operates if it is in offline mode. Temporary databases use Microsoft SQL Server Compact Edition as the DBMS.

Unlike the complete database that stores all data for all GCAS users, temporary database stores only data relevant to you. This means temporary database contains data for groups you have been assigned to, devices in these groups, and data for these devices only. Each user would have their own temporary databases. You would find these databases in `[installation directory]\DB-WorkOffline\`.

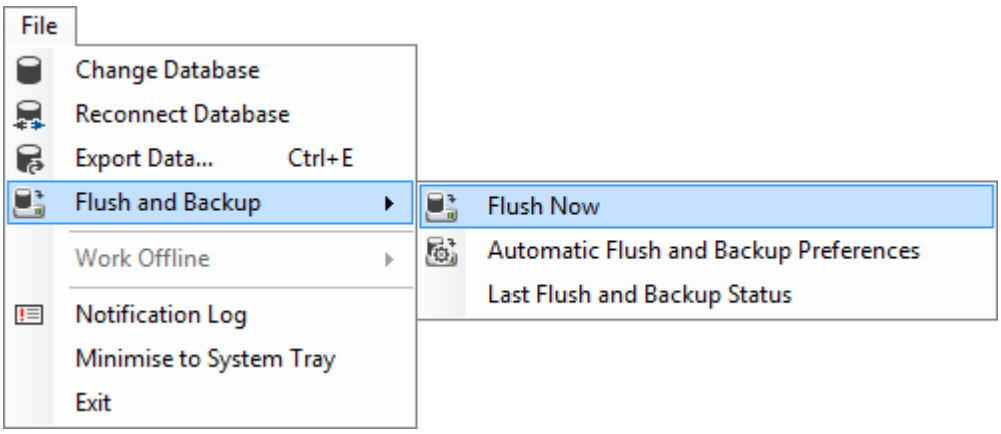
By default, GCAS Desktop synchronises data from the database server to temporary database for one latest month. That is, today minus one month. You can change this range from one month up to two years. To set up your temporary database and change how much data to synchronise, go to chapter 29 Working offline and 29.1 Set up temporary database.

2.8 Flush and Backup

Flush and backup is applicable for users with *local offline* databases—that is, Microsoft SQL Server Compact Edition or Microsoft Access. Users of local corporate databases or i-Vigilant central database may skip chapter 2.8 and 2.9.

Flushing a file means writing any pending changes to the file that existed in computer memory, into a permanent storage device—in this case, your hard disk drive. If for some unfortunate reason GCAS crashed, or a power cut happened, your database in computer memory/cache is lost. If GCAS doesn't flush the file at all, you will lose all data since the time GCAS was started. With a periodic flush, you lose only data since the last flush, not all the way back to GCAS start time. Nonetheless, GCAS cannot protect your hard disk from physical damages, especially during a power cut event.

To flush your database manually, go to the File menu on main user interface. Select **Flush and Backup**, then **Flush Now**.

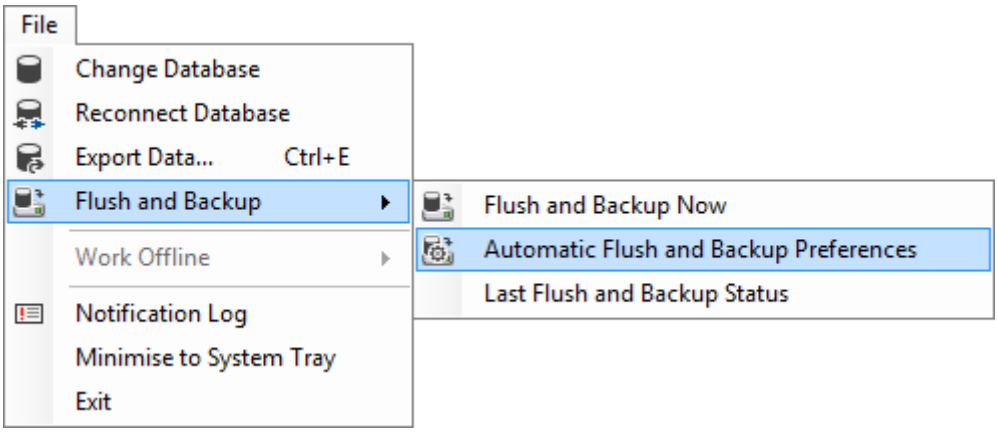


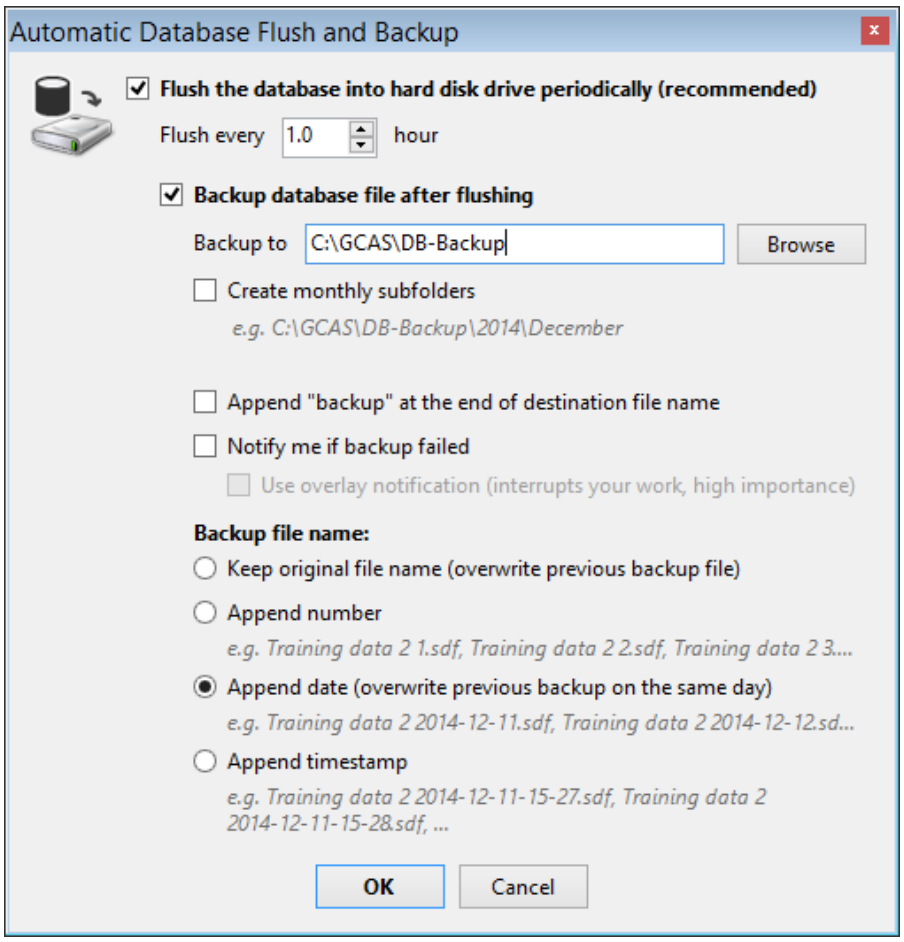
GCAS can also backup your database file after a flush. This feature is not yet turned on as you need to set up the backup destination directory beforehand.

By default, GCAS flushes your database file once every hour. You can configure the automatic flush settings at chapter 2.9 Automatic Flush and Backup.

2.9 Automatic Flush and Backup

On main user interface, go to the File menu, select **Flush and Backup**, and finally **Automatic Flush and Backup Preferences**. This menu shows the *Automatic Database Flush and Backup* dialogue.




Automatic Database Flush and Backup
Flush the database into hard disk drive periodically (recommended)
Flush every 1.0 hour
Backup database file after flushing
Backup to C:\GCAS\DB-Backup
Browse
Create monthly subfolders
e.g. C:\GCAS\DB-Backup\2014\December
Append "backup" at the end of destination file name
Notify me if backup failed
Use overlay notification (interrupts your work, high importance)
Backup file name:
Keep original file name (overwrite previous backup file)
Append number
e.g. Training data 2 1.sdf, Training data 2 2.sdf, Training data 2 3....
Append date (overwrite previous backup on the same day)
e.g. Training data 2 2014-12-11.sdf, Training data 2 2014-12-12.sd...
Append timestamp
e.g. Training data 2 2014-12-11-15-27.sdf, Training data 2 2014-12-11-15-28.sdf, ...
OK
Cancel

To turn off automatic flush, uncheck **Flush the database into hard disk drive periodically**. All other options will be turned off.

Set the desired flush interval at **Flush every** field. You can choose between 0.5 hours (every 30 minutes) and 168 hours (one week). The default is one hour.

To turn on automatic backup, check **Backup database file after flushing** and set the desired backup directory. The backup directory can be on an internal hard disk of the same PC, an external hard disk, a USB thumb drive, or at a network location. Be sure that external drives are plugged or network path is accessible when GCAS finished flushing. For network locations, GCAS Desktop supports UNC notation such as \\server\shared directory\ or mapped network drives. Currently there is no support for FTP, SSH/SFTP, or WebDAV access.

Create monthly subfolders: If this is ticked, GCAS creates additional folders having the format of year\month. The database backup files goes to the directory\year\month.

Append "backup" at the end of destination file name: Tick this to add "backup" to the file name. For example if your local offline database is Contoso.sdf, the backup file will be Contoso backup.sdf (or Contoso backup 1.sdf, Contoso backup 2014-12-11.sdf, depending on what selected at the file name options). Tick this option if you back up your database to the same directory as the local offline database file itself.

Notify me if backup failed: This option causes GCAS Desktop to display a tooltip notification if backup operation failed. Cause of failure can be an unplugged external drive, insufficient free space on the hard disk, your external drive has a write-protect switch, invalid or inaccessible network locations, a firewall that prevented GCAS from reaching the network location, or the target network server is down.

Use overlay notification: If this option is checked, GCAS Desktop prompts an overlay notification instead of a tooltip notification. Overlay notification is that black transparent overlay which covers entire working area — therefore it will interrupt your work, signifying backup is a high-priority task. Tooltip notification disappears after few seconds, but overlay notification remains until you click it to dismiss. Additionally, upon dismissing the overlay notification, GCAS Desktop will open Windows Explorer or File Explorer and point it to the location of your local offline database, so you can do the backup manually.

There are four options that determine how the backup file shall be named.

1. **Keep original file name**: The backup file has the same name as the original database file (with additional word "backup" if you opt to append "backup" at the end of filename). GCAS overwrites the previous backup file because it has the same name.
2. **Append number**: GCAS Desktop appends a sequential number at the end of file name. This option prevents overwriting.
3. **Append date**: GCAS Desktop appends today's date to the backup file with the format of yyyy-mm-dd. This overwrites previous backup files on the same day, hence only one backup file can exist per day.

4. **Append timestamp**: GCAS Desktop appends today's date and current hour and minute with the format of yyyy-mm-dd-hh-nn. This option prevents overwriting.

3 Users, Groups, and Workspaces

GCAS *users* are users who are authorised to access data in GCAS database. GCAS requires users to enter their valid credential before presenting the main interface. Each user has their own user type and role, which control what kinds of data in the database are accessible to the user and what permissions the user has over the data.

When a GCAS user is assigned into a *group*, this implies the user is authorised to access, read, and write data to a portion of GCAS database which is allocated for this particular group. A user may be assigned to multiple groups.

3.1 User Types and Roles (Concept)

User types and *user roles* constitute the access control list (ACL). If you use i-Vigilant central database, this ACL is shared between GCAS Web and GCAS Desktop.

User types control which *menus* are available to the user. Default installation of GCAS would set up three user types: Administrator, super user, and general user. Administrator has access to all areas of GCAS modules and menus, while general user has access to essential features only.

You can create custom user types and assign custom menu permissions to each of them if you are the GCAS administrator. To do so, read chapter 27.2 Define new user types and roles and 27.5 Menu permissions.

User roles control which *actions* are available to the user. An *action* is a specific command available in some modules such as Footprint, Calibration Data, Mole Composition, and Devices. Those commands are accessible through the **Action** menu on the menu bar. Default installation of GCAS Desktop would set up six user roles:

- System administrator
- Engineer 1
- Engineer 2
- Partner
- Read-only
- Custom

Similar to user types, system administrator has access to all actions in both GCAS Web and GCAS Desktop. On the other side, read-only role has the least access.

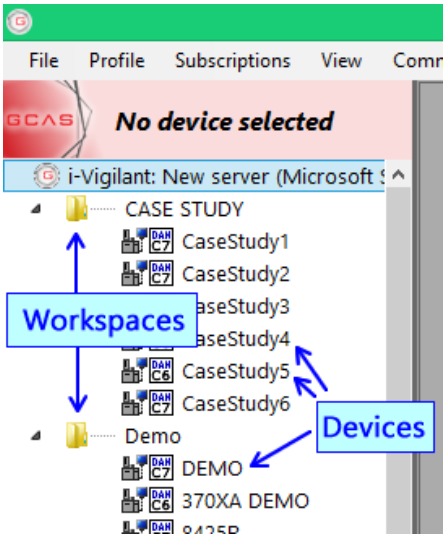
You can also define your own user roles and aszsign action permissions to them if you are the GCAS administrator. Go to chapter 27.2 Define new user types and roles and 27.6 Action permissions to read more.

3.2 Groups and Workspaces (Concept)

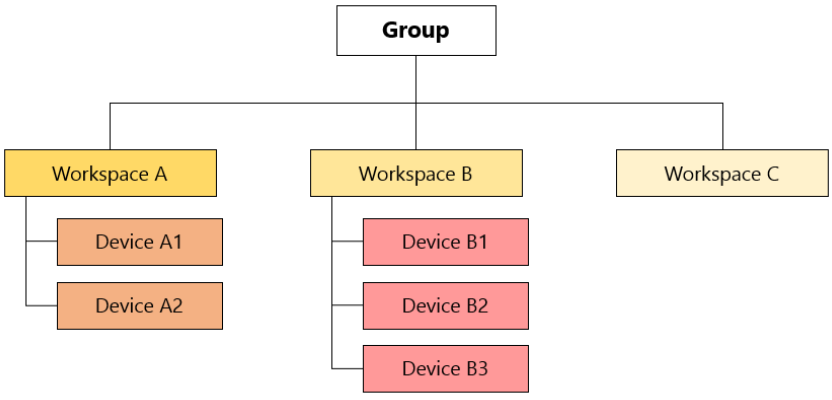
Group is the highest hierarchy of all GCs. Each GC device has to be a part of a group. A GCAS database should have at least one group. For example, a company called ACME Ltd. has three different platforms. These three platforms are all part of "*Platforms*" group.

Workspace is a way to separate GC devices which belong to the same group. Each group may have several workspaces. For instance group *Platforms* has three different platforms, so each platform has its own separate workspace: *Platform A*, *Platform B*, and *Platform C*.

You should see workspaces of the groups assigned to you on the *device panel* in the main user interface once you have logged in. Underneath these workspaces are GC devices. If you don't see anything on this panel, your GCAS administrator could have not assigned your user account to any groups yet.



One group may have several workspaces, and one workspace contains many GC devices. One GC device cannot be assigned to multiple workspaces. Chapter 24 Device Management explains more about creating, moving, and deleting devices (requires user type "super user"). Chapter 27.3 Manage Groups explains about managing groups and workspaces within groups (requires user type "administrator").



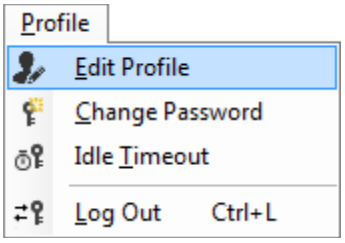
3.3 Edit Your Profile and Change Your Password

Each user has their associated user profile and credential. *User profile* is a set of personal information such as real name, email address, postal address, and phone number. *Credential* is the username and password required to log in to GCAS database.

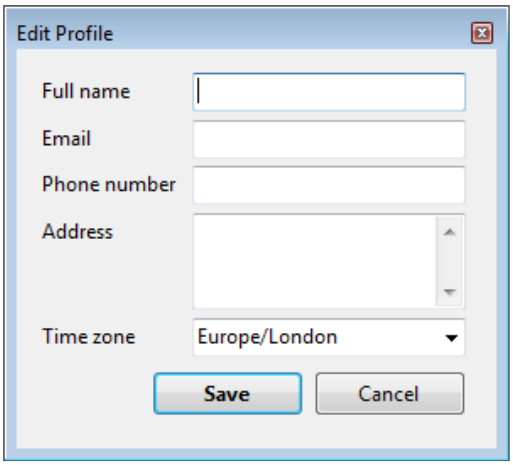
3.3.1 Edit Your Profile

To edit your user profile, follow the steps below.

1. Go to the Profile menu > **Edit profile**. If you do no see this menu, your user type may not have the menu permission for it. Contact your GCAS administrator.



2. This menu brings forth the *Edit Profile* dialogue.



3. Enter the information then click Save.

Regarding time zone

If you use i-Vigilant central database, all user comments (e.g. in the Footprint or Calibration Data) have their timestamps converted to server time zone. GCAS Desktop uses this time zone information in your user profile to display timestamps of user comments in the correct time, including times when you are travelling. If you enter a time zone other than the actual time zone you are living in, GCAS Desktop may display user comments with wrong time.

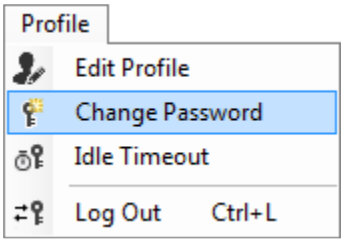
If you use local corporate database or local offline database, GCAS Desktop assumes the server time zone is the same as your time zone. No time zone conversion is performed.

Empty time zone information is replaced by the default **Europe/London** (UTC+0 standard time, UTC+1 daylight saving time).

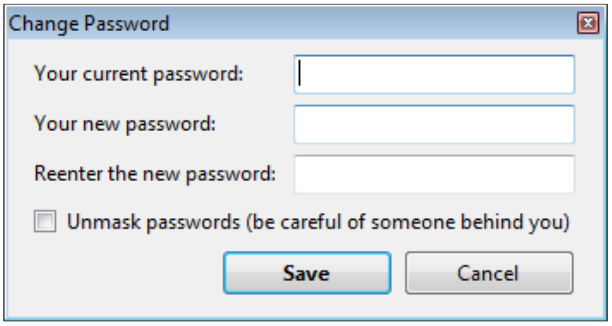
3.3.2 Change Your Password

Once your GCAS administrator finished creating your user account, it has usually a default password of "**password**" (all lowercase). Otherwise, your administrator should have told you about your initial password. To change your password, follow these steps.

1. Go to the Profile menu > **Change Password**. If you don't see this menu on the menu bar, your user type may not have the menu permission for it (i.e. your GCAS administrator prohibits you from changing password).



2. The *Change Password* dialogue will appear.



3. Type your current password once and your desired password twice. Then click **Save** to commit the change.
4. Use the new password for the next time you log in to GCAS Desktop.

3.4 Forgot Your Password?

If you forgot your password and you use i-Vigilant central database, send a request for password reset quoting your GCAS username to support@i-vigilant.com then we will reset your password.

If you use local corporate database or local offline database, contact your GCAS administrator to reset your password. To GCAS administrators, follow chapter 27.1 Manage Users to reset a user's password.

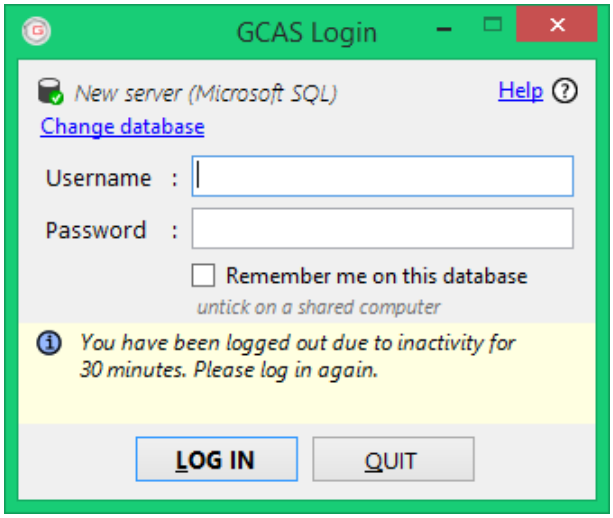
3.5 Logging Out

Go to the Profile menu > **Log Out** or press `Ctrl+L` shortcut key to log out. The next user can now log in.

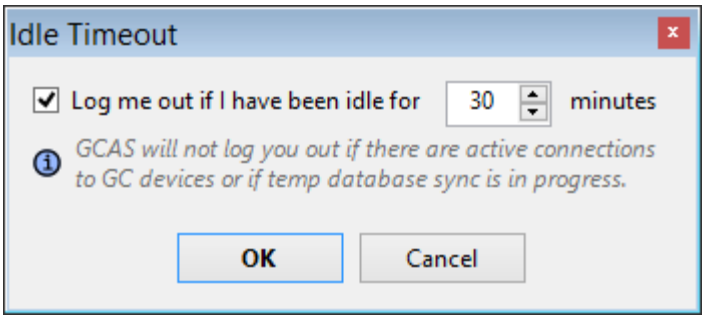
Be informed that if GCAS Desktop is in offline mode, only users who have set up their temporary databases can log in to GCAS.

3.6 Automatic Logout on Inactivity

To protect your data, GCAS Desktop can trigger automatic logout if it has been idle for certain period of time. The login form will look like this if you leave GCAS Desktop without any activity for some amount of time.



By default, GCAS Desktop *does not* log you out automatically. To turn on this feature and to configure the idle timeout threshold, go to the Profile menu > **Idle timeout**.


Idle Timeout
Log me out if I have been idle for
30
minutes
GCAS will not log you out if there are active connections to GC devices or if temp database sync is in progress.
OK
Cancel

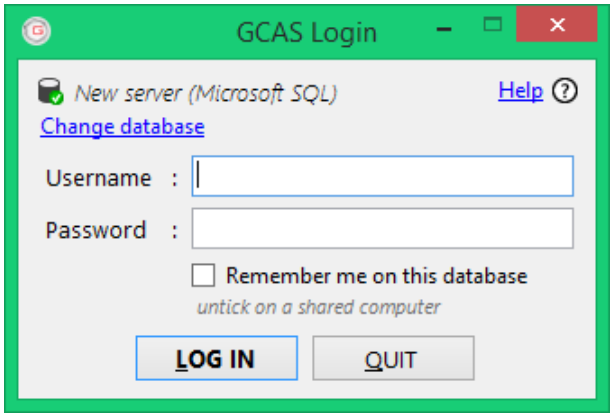
GCAS pauses the idle timer if you have data capture operation running in background, or if database synchronisation between database server and temporary database is in progress.

4 The User Interface

This chapter is a quick guide about GCAS Desktop user interface.

4.1 Login Form

When you launch GCAS Desktop, you see a splash screen for few seconds then you are presented with login form. Enter your GCAS username and password then click **Log in**.

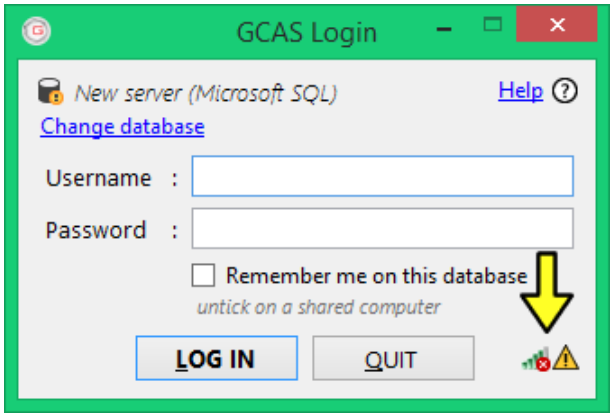


At the top, the login form displays which database you are connected to. In case you frequently switch between databases, this information helps you to enter correct GCAS credential of current database. You can change database straight from here, simply click **Change database** link under the database name.

Icon on top-left corner indicates database connectivity status.

Icon	Meaning
	Database connection is closed. This may indicate network problem or I/O error. If you don't have GCAS feature *Work-offline Capability* in your GCAS licence, this icon is displayed during network problem.
(spinning)	Database connection is in progress. You can enter credential but GCAS Desktop must wait until connection is opened successfully before validating your credential.
	Database connection is open.
	No database connection currently present. GCAS is in *offline mode* (see chapter 29.10) thus no connection is initiated until you log in.

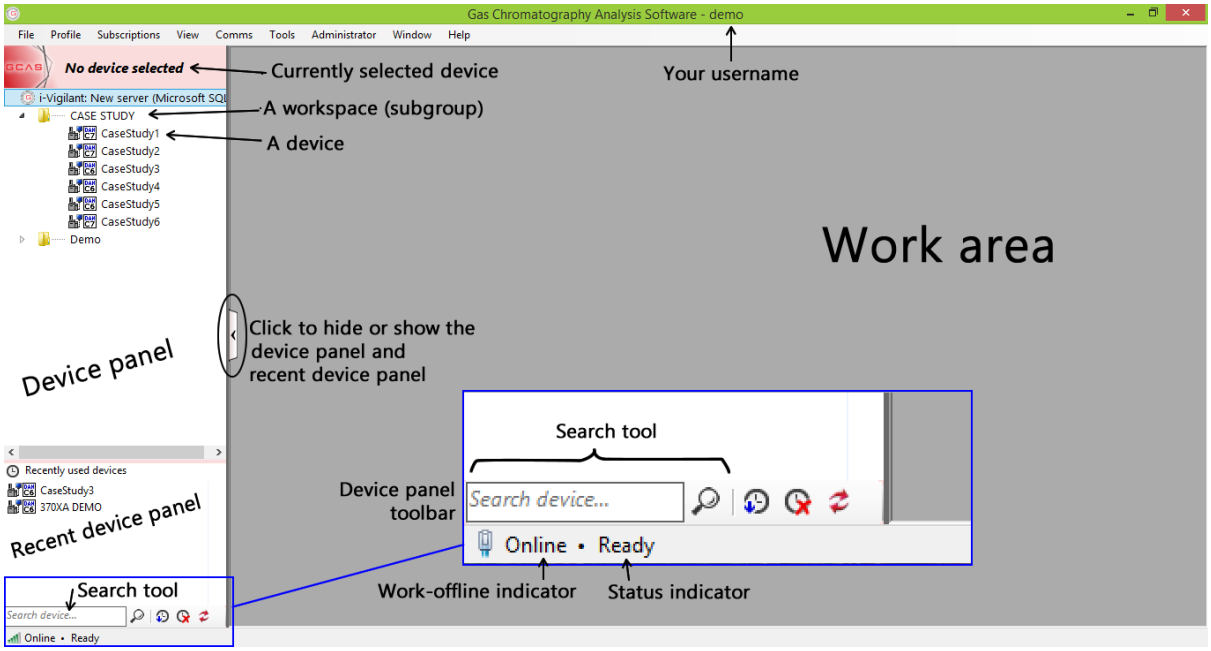
If you see the offline warning icon next to the Quit button similar to the screenshot below, this indicates the login form is in *offline mode*. Read more on chapter 29.10 Login Form in Offline Mode. You need the GCAS feature *Work-offline Capability* to be included in your GCAS licence to use offline mode.



The check box **Remember me on this database** is intended to speed up login process in case you have only one user in the GCAS database (thus you always use the same credential) and it is a private computer, meaning no one else uses that computer. Ticking this box causes GCAS Desktop to automatically fill in your username and password the next time GCAS is launched, therefore you can simply hit `Enter` key to log in. Never tick this box on a shared or public computer.

4.2 Main User Interface

Once you have entered your valid credential, you would see the main user interface.



4.2.1 Device Panel

The **device panel** lists all *workspaces* assigned to you and all GC devices under these workspaces. Click on a GC device to *select* it. Features such as Footprint, Calibration data, Mole Composition, or Uncertainty Calculator works with one device only, therefore make sure you select the correct device. The selected device name is displayed on the top of device panel. Learn more about workspaces.

Icon	Meaning
	Daniel GC, either C6+ complete or C6+ without neopentane.
	Daniel GC, either C7+ complete or C7+ without neopentane.
	Daniel GC, either C9+ complete or C9+ without neopentane.
	Daniel GC, either C10+ complete or C10+ without neopentane.
	ABB GC, either C6+ complete or C6+ without neopentane.
	ABB GC, either C7+ complete or C7+ without neopentane.
	Unsupported GC.

4.2.2 Recent Device Panel

Below the device panel is known as **recent device panel**. This section lists your recently used devices. Clicking a device on this list also *selects* it, which is the same effect as selecting the same device from the device panel above. Recent device list is persistent, that is, this list is preserved after you exit GCAS Desktop and run it again the next time.

4.2.3 Search Tool and Toolbar

There is a small toolbar under recent device panel. It has a **search tool** to help you find a device if you have a lot of GC devices on your device panel. Type the device name and click  **Search**. When you are in search mode, the *recent device* panel temporarily turns into *search results* panel. After you find the device in the search result list, click the device to *select* it or click  **Finish searching** to close the search tool.

The toolbar also contains three more buttons.

Button	What it does
 Hide recent devices	Hides the recent device panel. Your main device panel fills the entire sidebar.
 Show recent devices	If the recent device panel is hidden, this button brings it back visible.
 Clear recent devices	Clears your recent device list.
 Refresh devices	Reloads all workspaces and GC devices on your device panel.

4.2.4 Status Bar

Status bar at the bottom of the form hosts two elements: work-offline indicator and status indicator.

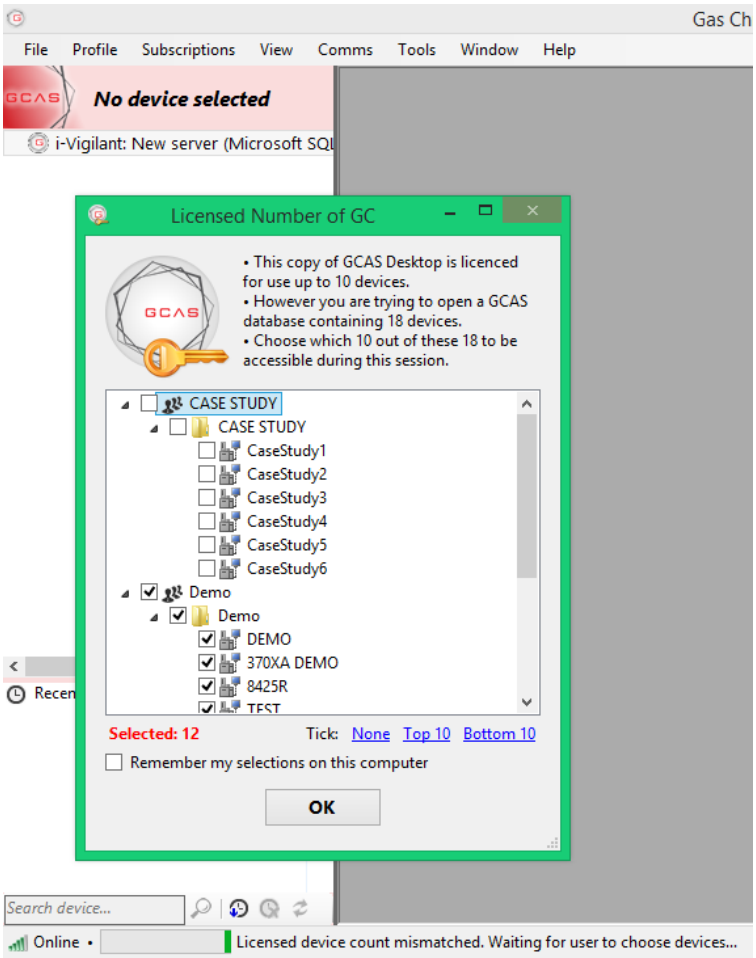
Work-offline indicator appears if you have *Work-offline Capability* included in your GCAS licence. The indicator displays one of these symbols.

Icon (depending on network medium)	**Text**	**Meaning**
	Online	GCAS is working online and is connected to database server.
	Offline	GCAS is working offline and is connected to temporary database.
	Disconnected	GCAS is not connected to any database servers. Go to File menu > Reconnect Database to reconnect.

Status indicator displays general status of GCAS Desktop and status bar notifications, which are usually related to database, licence update, and later on–software updates. Specific status associated with specific module will not be displayed on the status bar, but on their own form instead. For example, Footprint form, Calibration Data form, Mole Composition form, and Data Analysis form have their own busy indicator on each user interface. Most of the time, status indicator reads "`Ready`".

4.3 *Choose Devices* Dialogue

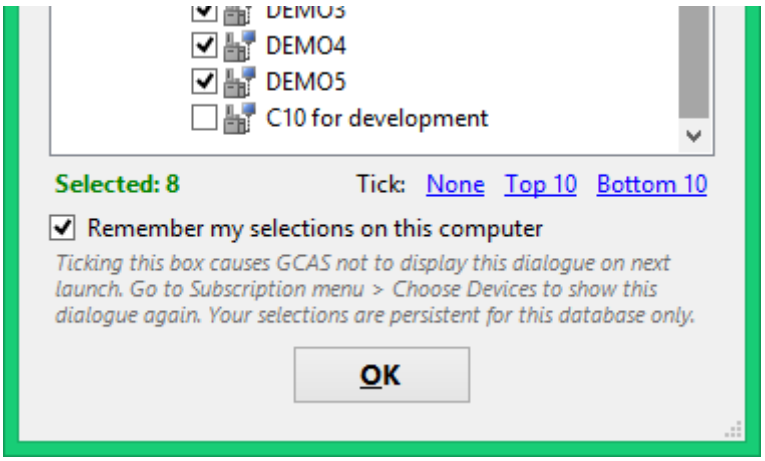
Choose Devices dialogue appears if you open a GCAS database having number of GC devices exceeds the limit permitted by your GCAS licence. This dialogue lets you choose which GC devices to be *accessible* during current session of GCAS Desktop.



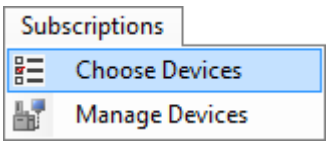
As an example, meet Frank. He is a talented GC specialist service engineer. He bought a GCAS licence of 5 GC devices. One day a customer called, requesting his help to analyse problems on their GCs. The customer exported part of their GCAS database to a Microsoft SQL server compact database and handed the .sdf file to Frank. Unfortunately this database has 8 devices. When Frank changes database to this .sdf file, GCAS presents *Choose Devices* dialogue when the main window is being loaded. As his licence only permits five GC devices maximum, Frank must choose which five out of these eight to be visible during this session. To see the other three, Frank needs to restart GCAS to end current session and start a new session, thus displaying the *Choose Devices* dialogue again. This time, he chooses the remaining three (and optionally two out of the other five).

4.3.1 Persistent Device Selection

Device selection made through *Choose Devices* dialogue is not persistent. Next time GCAS Desktop is launched, it presents *Choose Devices* dialogue again, allowing you to select the other devices that were not visible during previous session.


DEMO4
DEMO5
C10 for development
Selected: 8
Tick: None Top 10 Bottom 10
Remember my selections on this computer
Ticking this box causes GCAS not to display this dialogue on next launch. Go to Subscription menu > Choose Devices to show this dialogue again. Your selections are persistent for this database only.
OK

To make your device selection persistent, tick **Remember my selections on this computer**. This causes GCAS to remember your selection for the next time GCAS is launched and thereafter. The selection is valid for current GCAS database only. If you change into different GCAS database, *Choose Devices* dialogue may re-appear. Again, you have the option to remember your selections for that database as well.

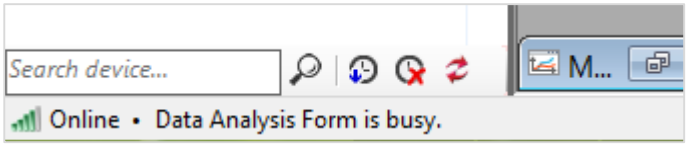


At some point you may change your mind. Go to the Subscription menu > **Choose Devices** to display this dialogue again. Here you can change your selected devices to make visible, or simply untick **Remember my selections on this computer** to cancel the persistence. Unticking the check box causes GCAS Desktop to re-display *Choose Devices* dialogue the next time GCAS is launched. Please note this menu is not visible directly after making selection through *Choose Devices* dialogue. It will be there the next time GCAS Desktop is launched, so you need to spend one session with your current device selections first.

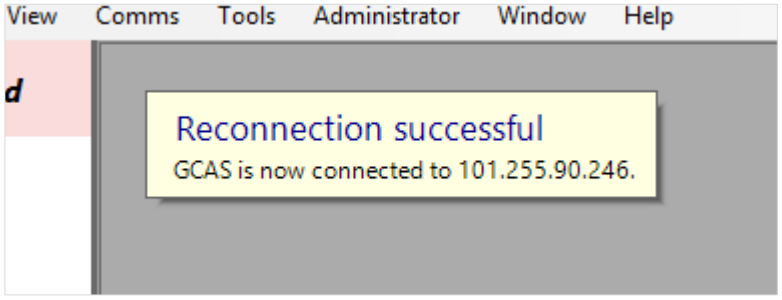
4.4 Notifications

GCAS Desktop has four kinds of notifications.

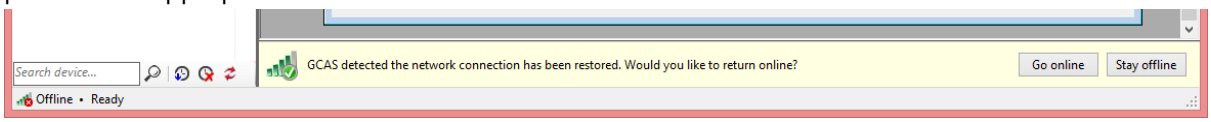
1. **Status bar notification**
   Status bar notification is displayed on—what else?—the status bar. This kind of notification usually contains less important messages. You probably see the message "xyz form is busy" most often when you attempt to close a form which was busy calculating. Status bar notifications dismiss themselves after few seconds.



2. **Tooltip notification**
   Tooltip notifications contain only informational messages but GCAS needs to catch your attention. It appears at the top-left corner of work area. Tooltip notifications dismiss themselves after few seconds.

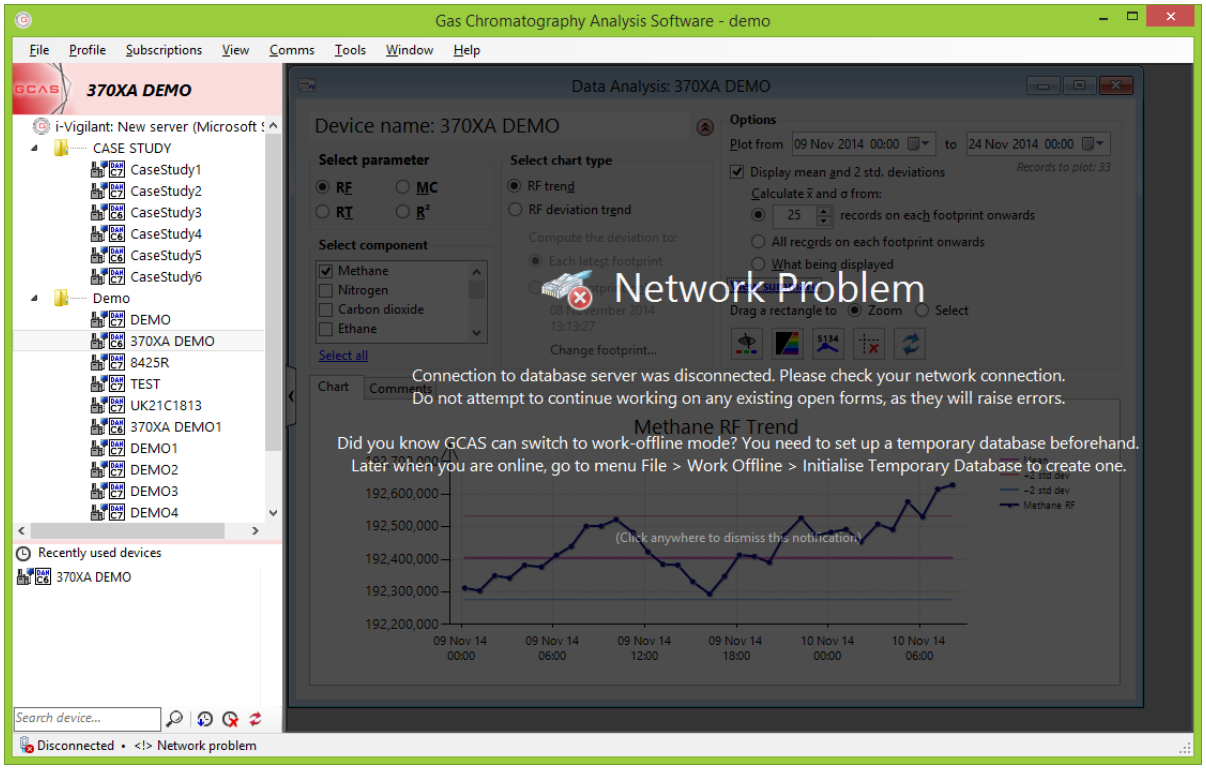


3. **Panel notification**
   GCAS Desktop uses panel notification to ask your decision. The notification is displayed at the bottom of work area. Panel notifications have up to three buttons. Click one of them to perform the appropriate action and dismiss the notification.

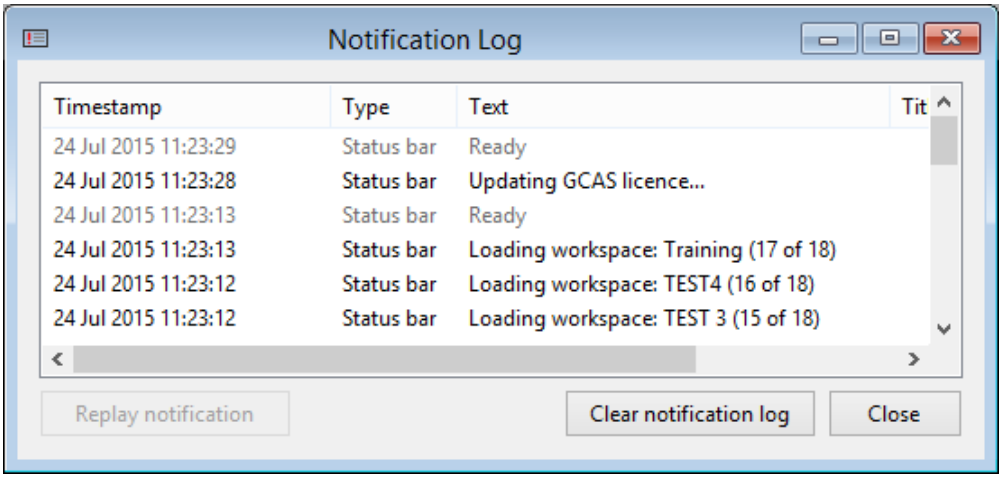

Search device...
GCAS detected the network connection has been restored. Would you like to return online?
Go online
Stay offline
Offline • Ready

4. **Overlay notification**
   Possibly the most annoying one, overlay notification is the black transparent window which covers the entire work area. Overlay notifications interrupt your work therefore GCAS Desktop reserves them for urgent messages only. Click anywhere on the overlay to dismiss the

notification.


Gas Chromatography Analysis Software - demo
File Profile Subscriptions View Comms Tools Window Help
370XA DEMO
Data Analysis: 370XA DEMO
Device name: 370XA DEMO
Network Problem
Connection to database server was disconnected. Please check your network connection.
Do not attempt to continue working on any existing open forms, as they will raise errors.
Did you know GCAS can switch to work-offline mode? You need to set up a temporary database beforehand.
Later when you are online, go to menu File > Work Offline > Initialise Temporary Database to create one.
(Click anywhere to dismiss this notification)
Methane RF Trend
Disconnected • <!> Network problem

In case you missed a notification, check the *Notification Log* from the **File** menu. *Notification Log* window displays the last 10,000 notifications. Click **Replay notification** to replay it. Replayed panel notifications still show decision buttons, but this time these buttons serve no function other than to dismiss the notification.


Notification Log
Timestamp
Type
Text
24 Jul 2015 11:23:29 Status bar Ready
24 Jul 2015 11:23:28 Status bar Updating GCAS licence...
24 Jul 2015 11:23:13 Status bar Ready
24 Jul 2015 11:23:13 Status bar Loading workspace: Training (17 of 18)
24 Jul 2015 11:23:12 Status bar Loading workspace: TEST4 (16 of 18)
24 Jul 2015 11:23:12 Status bar Loading workspace: TEST 3 (15 of 18)
Replay notification
Clear notification log
Close

4.5 Standard Colour Palette

This chapter is hidden on the HTML version of GCAS Desktop manual. It only serves as a link destination target from chapters explaining alternative colour scheme for colourblind users.

This table lists the standard colour pallete which GCAS uses for all charts across different modules.

Component	Colour	Red (0-255)	Green (0-255)	Blue (0-255)
Methane		8	13	145
Ethane		3	225	72
Propane		226	127	20
i-Butane		226	214	45
n-Butane		168	149	30
Neopentane		12	172	48
i-Pentane		205	226	118
n-Pentane		35	114	21
Hexane		97	109	95
Heptane		53	127	220
Octane		132	60	192
Nonane		76	34	110
Decane		4	2	0
Nitrogen		234	58	58
Carbon dioxide		21	210	198
Unnormalised total or R^2 pass limit		255	0	0
Mean		233	94	211
Mean + 2 standard deviations		241	136	136
Mean – 2 standard deviations		116	170	236

When **colourblind-assist** is turned on, GCAS Desktop switches to this alternative colour palette and turns on several visual assistances. This is to aid users with protanopia and deuteranopia.

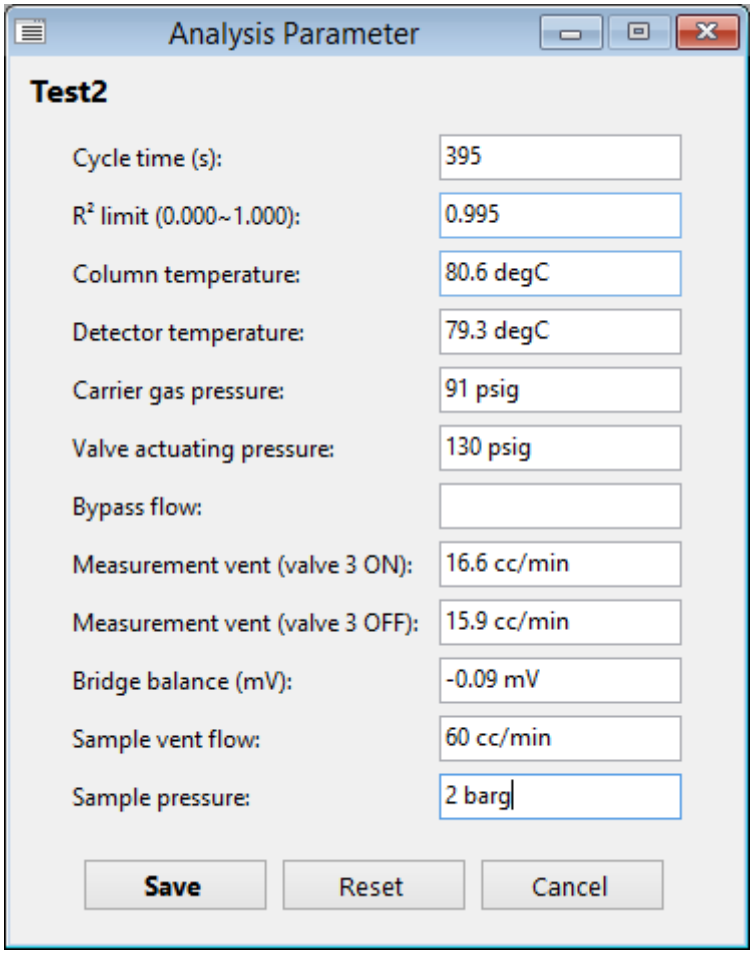
Component	Colour	R	G	B	Line chart	Pie chart	Point chart
Methane		8	13	145	Solid line	Solid	▲
Ethane		214	185	90	Solid line	Solid	▲
Propane		180	134	20	Dashed line	Horizontal black dash	◆
i-Butane		255	255	0	Solid line + black shadow	Solid	▲
n-Butane		188	145	29	Solid line	Solid	■
Neopentane		151	125	46	Solid line	10% white-dotted	▲
i-Pentane		247	217	117	Dashed line + black shadow	10% black-dotted	◆
n-Pentane		119	92	20	Dash-dot	Vertical white dash	■
Hexane		109	106	94	Solid line	Solid	▲
Heptane		94	115	219	Solid line	Diagonal white stripes	▲
Octane		53	74	193	Dash-dot	Solid	★
Nonane		30	42	110	Dashed line	Diagonal white criss-cross	◆
Decane		4	2	0	Solid line	Solid	▲
Nitrogen		84	78	59	Dash-dot-dot	25% white-dotted	★
Carbon dioxide		156	163	195	Dash-dot + black shadow	Solid	■
Unnorm. total/R^2 pass		60	46	0	Solid line	Solid	◆

Mean		155	151	136	Solid line	Not applicable
Mean + 2 std dev		97	116	212	Solid line	
Mean – 2 std dev		146	162	235	Solid line	

5 Analysis Parameter

Analysis parameters are collection of information that could assist users when analysing the GC performance. When something goes wrong, it is a good idea to compare the parameters stored in this form and the actual condition observed on the GC device.

To view or edit analysis parameter for a particular device, select that device on the device panel on the main user interface and then go to the View menu > **Analysis Parameter**.



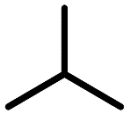
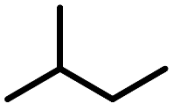
The first two fields, **cycle time** and **R^2 limit**, accept only numeric value. The rest can accept alphanumeric characters. If no R^2 limit entered, GCAS assumes the default R^2 threshold to be **0.995**. Click **Save** to commit the change, **Cancel** to discard the change, or **Reset** to reload previous values.

If all input fields are greyed out, your user account might not have sufficient action permission to edit Analysis Parameter. Contact your GCAS administrator.

6 C-number Glossary

On GCAS Desktop and GCAS Web user interface, users might see C1, C2, C3, and so on. These are carbon atom count of supported alkane gases.

Current version of GCAS Desktop supports C1 (methane) to C10 (decane). GCAS Web only supports C1 to C7 (heptane)

Notation	Alternative notation	Gas name	Formula
C1	C1	Methane	CH_4
C2	C2	Ethane	C_2H_6
C3	C3	Propane	C_3H_8
C4	NC4	n-Butane	C_4H_{10} 
	IC4	i-Butane	C_4H_{10} 
C5	NC5	n-Pentane	C_5H_{12} 
	IC5	i-Pentane	C_5H_{12} 
	NEOC5	Neopentane	C_5H_{12} 
C6	C6	Hexane	C_6H_{14}
C7	C7	Heptane	C_7H_{16}
C8	C8	Octane	C_8H_{18}
C9	C9	Nonane	C_9H_{20}
C10	C10	Decane	$C_{10}H_{22}$

In case of butane and pentane, C4 (without prefix N or I) refers to n-Butane while C5 means n-Pentane.

7 Footprint and Calibration Data

A *calibration data* is one record or snapshot of gas properties of the analyte read by the GC device. GCAS records two main properties, which are the response factor (RF) and retention time (RT).

GCAS assumes the response factor is calculated using *peak area* formula.

$$RF = \frac{peak\ area}{mole\ composition}$$

If your GC device uses *peak height* formula, that is, peak height divided by mole composition, unfortunately your GC device is not compatible with GCAS. Or to the least, the RF chart on both Footprint form and Calibration Data form may not help you in the analysis of GC health status.

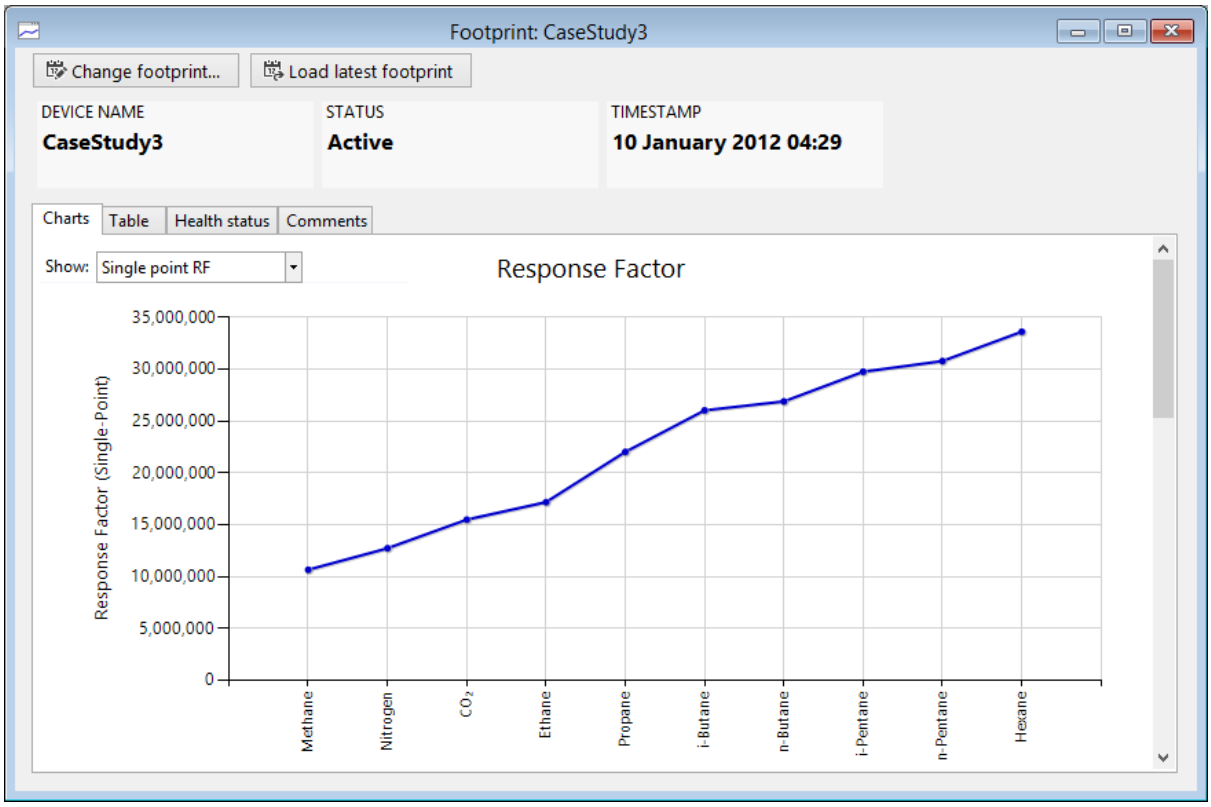
Some GC devices use the inverse formula, which is mole composition divided by peak area. These devices are still compatible with GCAS Desktop however, with a few differences:

1. RF chart will descend downwards instead of the usual ascending shape,
2. RF values will be somewhere within the order of 10^{-6} to 10^{-8}, instead of 10^{6} to 10^{8}.
3. Correlation charts will show a downward slope or negative gradient, unlike the usual upward slope. However R^2 calculation stays the same.

Footprint is a special type of calibration data which is usually:

1. Is the first data of a GC device, or
2. A known good data as a reference of comparison for future calibration data.

7.1 The *Footprint* Form



Principal purpose of *Footprint* form is to show footprint records. It has three sections of charts, which are:

1. Response factor chart,
2. RF-MW log charts,
3. Retention time chart.

To open Footprint form, select the device from the device panel then go to View menu > **Footprint**.

Response factor chart graphs the response factor from gas with lowest to highest molecular weight. It should have a nice ascending slope, otherwise it may indicate problems within your GC device. In case you wonder what the dropdown **Single-point RF** is doing at the top-left corner, that is for ISO 10723 conversion and you also need GCAS feature *ISO 10723* in your licence. Jump to chatper 7.11 for more.

RF-MW log charts plot the base-10 logarithm of response factor (RF) against molecular weight (MW) of certain sequence of gases. They also calculate the regression line, and computes the square of Pearson correlation coefficient (R) value. If R^2 value is less than threshold set in the Analysis Parameter (default is 0.995), the number turns red and this may indicate problems within GC device.

Depending on your GC device type, there may be three or two RF-MW charts. Supported C6+ and C7+ devices have three correlation charts. GC devices with two ovens such as C9+ and C10+ only have two correlation charts.

Retention time chart graphs the retention time value, or *peak time*, in the unit of seconds (s).

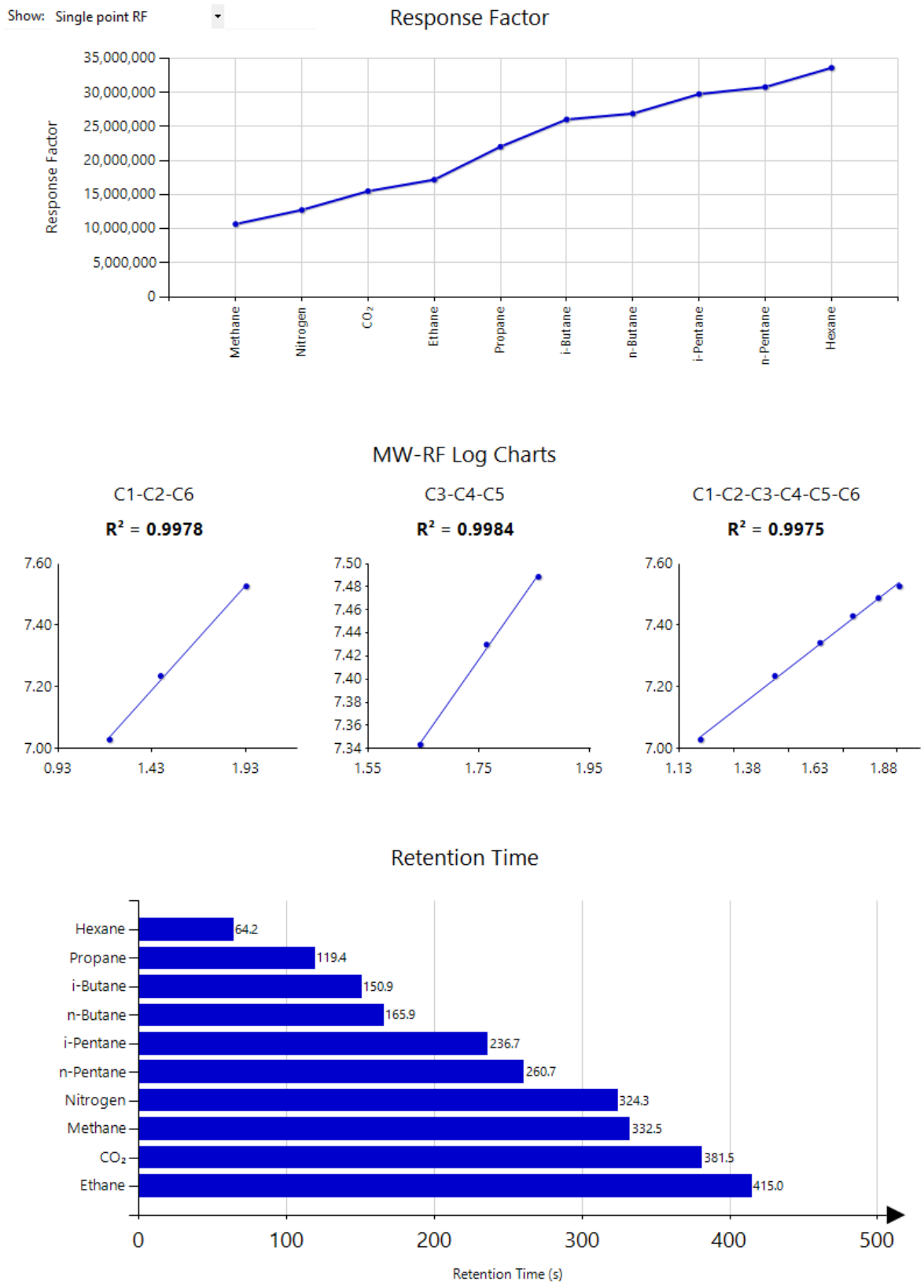


Chart view

To see the exact value of a data point on the charts, hover your mouse cursor over the dots. Otherwise, switch to table view. On table view, **MW** is the molecular weight in gram per mole.

Charts | Table | Health status | Comments

Component	RF	RT	MW
Methane	2,327,817	52.28	16.04246
Nitrogen	2,936,591	40.23	28.01340
Carbon dioxide	3,603,466	95.80	44.00950
Ethane	4,049,306	222.00	30.06904
Propane	3,498,922	48.65	44.09562
n-Butane	3,948,029	79.63	58.12220
i-Butane	3,942,288	70.80	58.12220
n-Pentane	4,893,218	161.25	72.14878
i-Pentane	4,762,046	137.95	72.14878
Hexane	5,400,630	23.83	86.17536

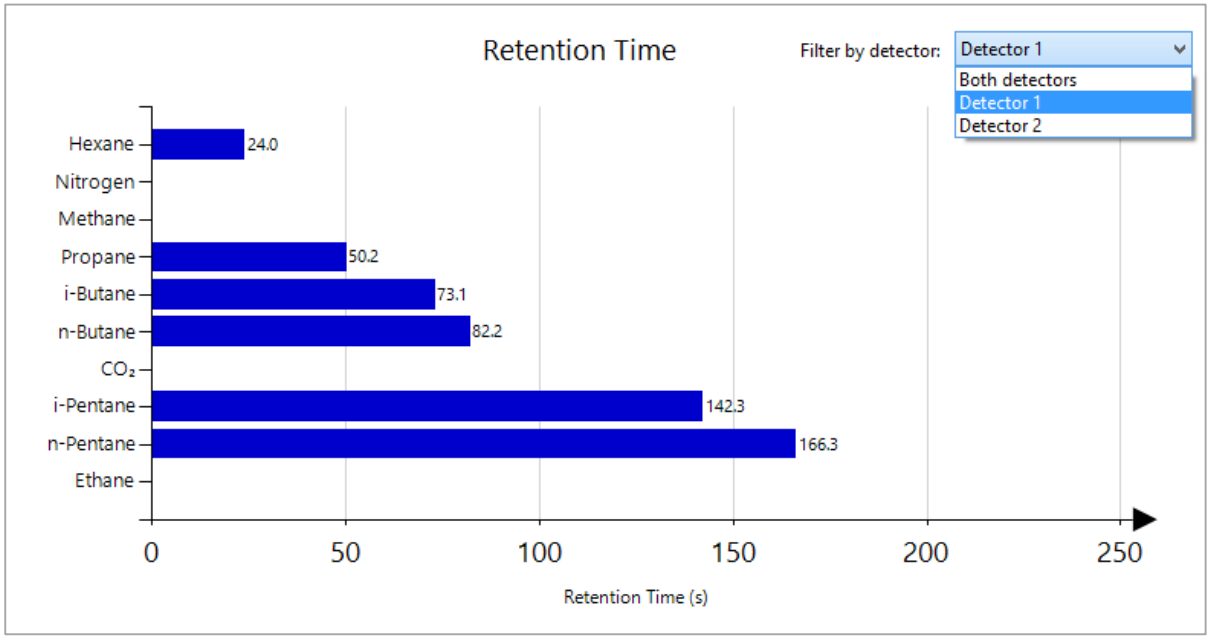
Table view

Special value −1

If you see −1 (negative one) for all RF values in this table view, this means the footprint does not have response factor data. This record may come from data capture operation but with an additional configuration to ignore incoming RF data. Similarly, if you see −1.00 for all RT values, the footprint does not have retention time data. Read more about incomplete footprint record.

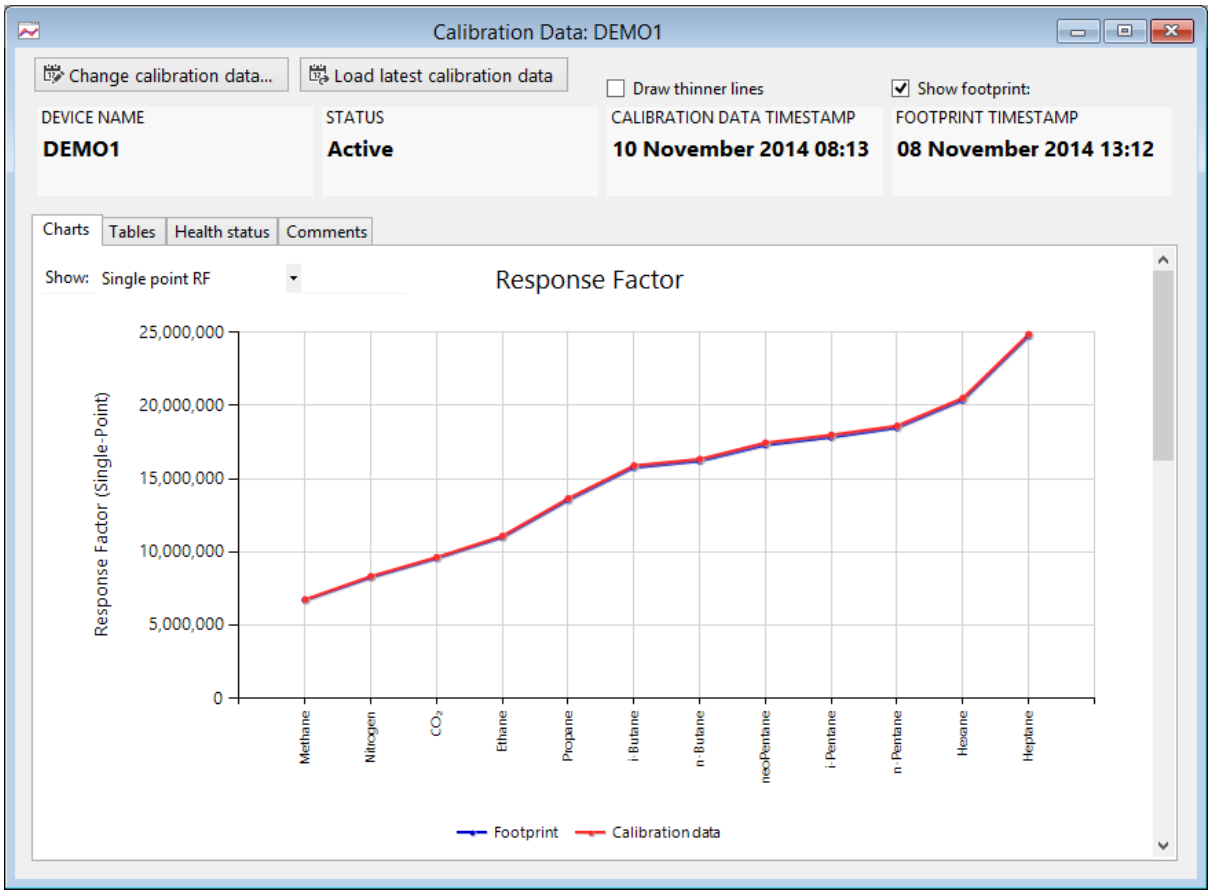
Retention time chart behaves differently for Daniel C9+/C10+ GCs and ABB GCs. Daniel C6+/C7+ devices have one detector and thus have a certain sort order and is constant. ABB devices have two detectors and Daniel C9+/C10+ have two ovens, thus the sort order does not apply because the sequence of analyte gas coming out from one detector is independent from the sequence of the other detector.

In this case, the RT chart is sorted by value. You can show bar charts from both detectors, from the first detector only, or from the second detector only.



Example of retention time chart for ABB C6+ GCs. There is a filter dropdown on the right side.

7.2 The *Calibration Data* Form

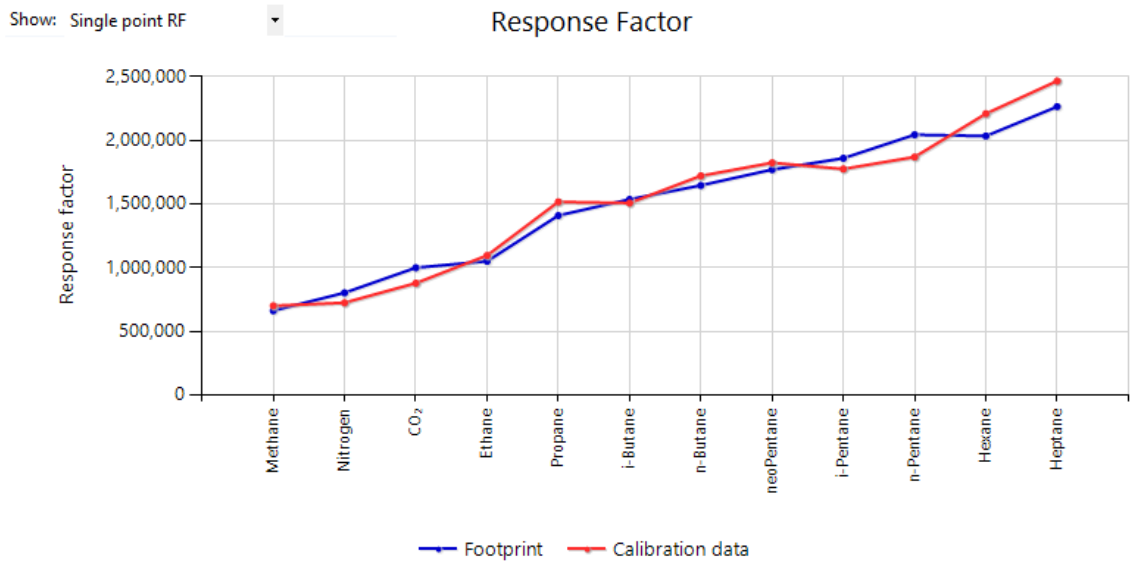


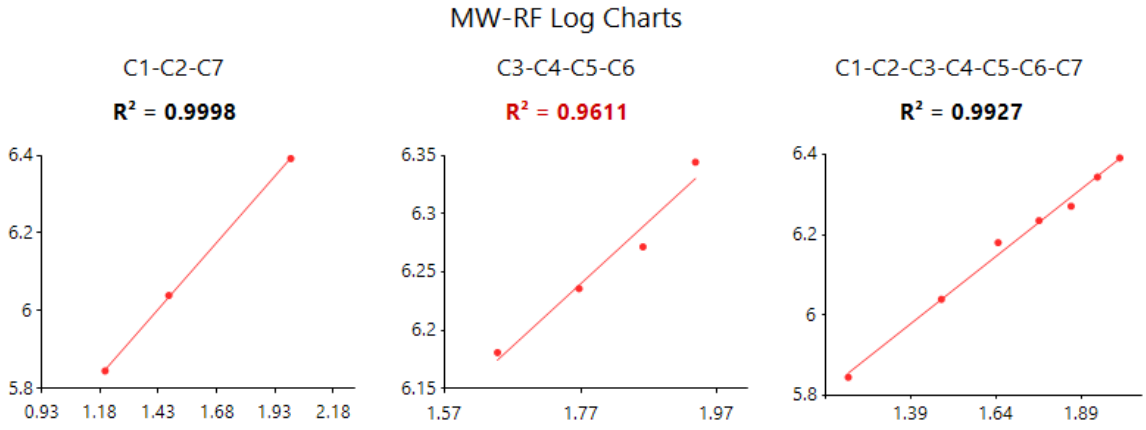
The main purpose of *Calibration Data* form is to show calibration data records and also to compare this calibration data to the immediate preceding footprint. Similar to Footprint form, the Calibration Data form has RF chart, RF-MW log charts, and RT chart.

To open Calibration Data form, select the desired device on the device panel on main user interface, and afterwards go to the View menu > **Calibration Data**.

Response factor chart and retention time chart display the calibration data values in **red** and footprint values in **blue**. You can hide the footprint (blue) line or bar by unticking the **Show footprint** check box on top of footprint timestamp display.

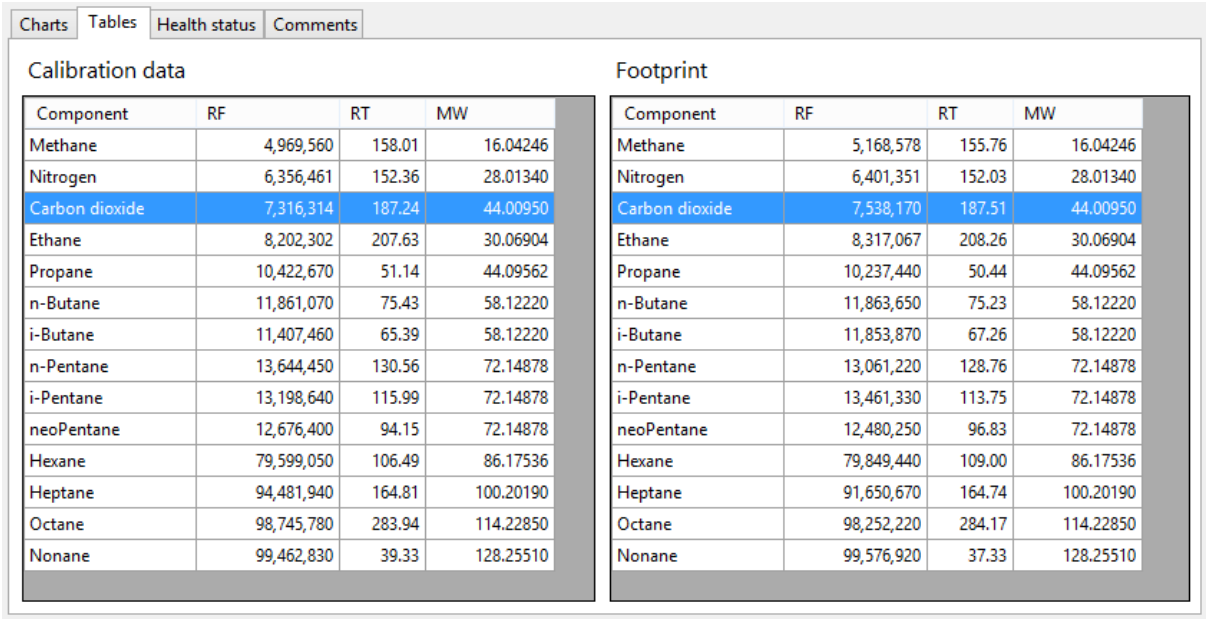
Unlike the other two charts, RF-MW logarithm charts only calculate the logarithm, regression line, and R^2 value of calibration data (red) record only.


Show: Single point RF
Response Factor
Response factor
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Methane
Nitrogen
CO2
Ethane
Propane
i-Butane
n-Butane
neoPentane
i-Pentane
n-Pentane
Hexane
Heptane
Footprint
Calibration data


MW-RF Log Charts
C1-C2-C7
R² = 0.9998
C3-C4-C5-C6
R² = 0.9611
C1-C2-C3-C4-C5-C6-C7
R² = 0.9927


Retention Time
Heptane
Propane
i-Butane
n-Butane
neoPentane
i-Pentane
n-Pentane
Hexane
Nitrogen
Methane
CO2
Ethane
29.2
28.5
56.5
57.4
74.8
74.8
83.3
82.3
99.7
99.9
123.8
121.8
134.5
135.6
252.2
252.8
266.3
267.9
272.1
270.6
303.6
304.0
326.1
326.3
Footprint
Calibration Data
0
50
100
150
200
250
300
350
Retention time (s)

In the same way as Footprint form, switch to table view to see exact numeric values. Here you will see the comparison to footprint value side-by-side.



Component	RF	RT	MW
Methane	4,969,560	158.01	16.04246
Nitrogen	6,356,461	152.36	28.01340
Carbon dioxide	7,316,314	187.24	44.00950
Ethane	8,202,302	207.63	30.06904
Propane	10,422,670	51.14	44.09562
n-Butane	11,861,070	75.43	58.12220
i-Butane	11,407,460	65.39	58.12220
n-Pentane	13,644,450	130.56	72.14878
i-Pentane	13,198,640	115.99	72.14878
neoPentane	12,676,400	94.15	72.14878
Hexane	79,599,050	106.49	86.17536
Heptane	94,481,940	164.81	100.20190
Octane	98,745,780	283.94	114.22850
Nonane	99,462,830	39.33	128.25510

Component	RF	RT	MW
Methane	5,168,578	155.76	16.04246
Nitrogen	6,401,351	152.03	28.01340
Carbon dioxide	7,538,170	187.51	44.00950
Ethane	8,317,067	208.26	30.06904
Propane	10,237,440	50.44	44.09562
n-Butane	11,863,650	75.23	58.12220
i-Butane	11,853,870	67.26	58.12220
n-Pentane	13,061,220	128.76	72.14878
i-Pentane	13,461,330	113.75	72.14878
neoPentane	12,480,250	96.83	72.14878
Hexane	79,849,440	109.00	86.17536
Heptane	91,650,670	164.74	100.20190
Octane	98,252,220	284.17	114.22850
Nonane	99,576,920	37.33	128.25510

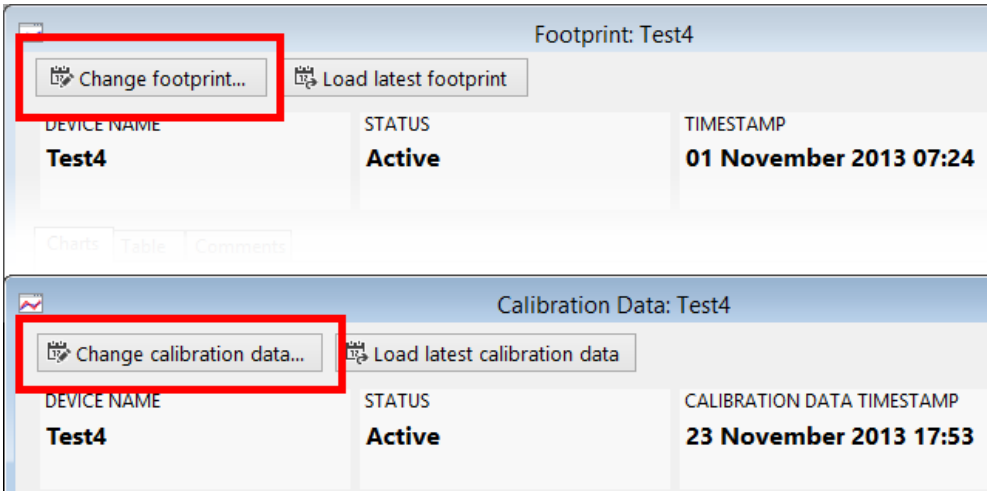
Special value −1

If you see −1 (negative one) for all RF values in one or both of the table views, this means the calibration data (or its footprint) does not have response factor data. This record may come from data capture operation but with an additional configuration to ignore incoming RF data. Similarly, if you see −1.00 for all RT values, the calibration data (or its footprint) does not have retention time data. Read more about incomplete calibration record.

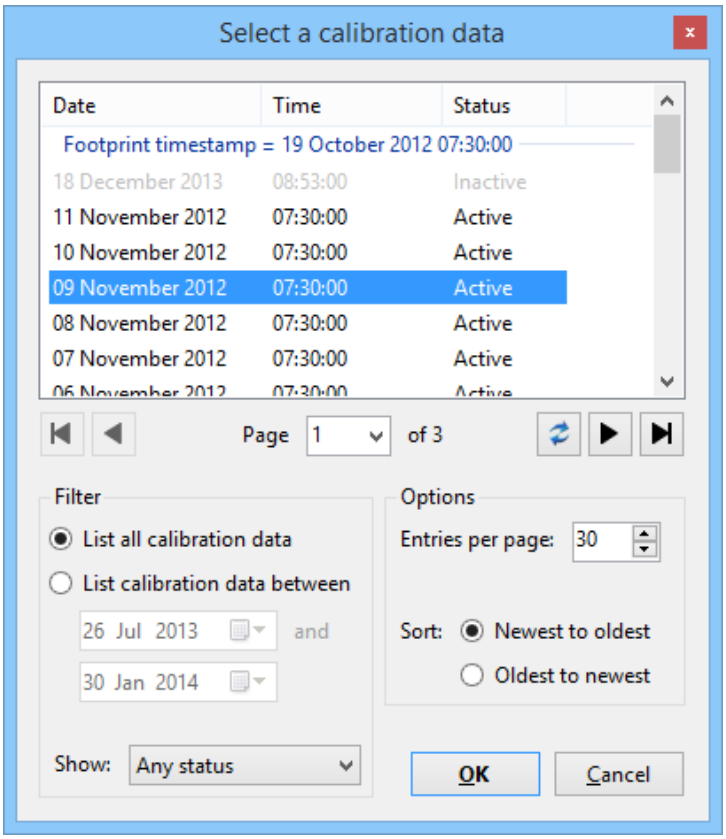
Retention time chart for ABB devices and Daniel C9+/C10+ is also sorted by value and you can apply filter to show data from which detector.

7.3 View Previous Footprints/Calibration Data

To browse previous record of footprint or calibration data, click **Change footprint** or **Change calibration data** button at the top region of the form.



Select a different record then click **OK** button or double click the record on this list.



You can always reload the latest record through **Load latest footprint** or **Load latest calibration data** button.

7.4 Import New Footprint/Calibration Data

To import a new footprint or calibration data, follow the steps below.

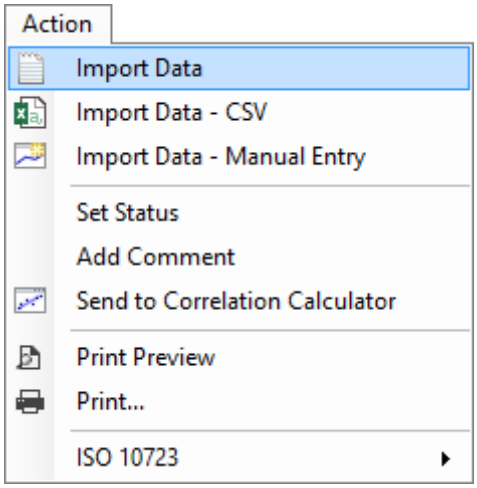
1. Select the desired GC device on your device panel.

2. Open *Footprint* or *Calibration Data* form through the View > Footprint menu or View > Calibration Data.
   If you import new data through Footprint form, the imported data shall be marked as footprint. If you import new data through Calibration Data form, the data will be marked as a calibration data.

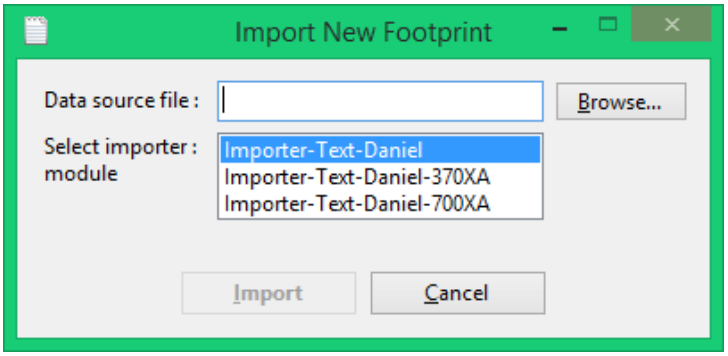
3. Notice the Action menu on the menu bar. To continue, pick one of the supported import formats.
   a. Text import
   b. CSV import
   c. Manual entry

7.4.1 Text Import

GCAS Desktop supports calibration report files generated by GC devices manufactured by Daniel Industries and ABB. If you have the file, open the Action menu and select **Import Data**. If you don't see this menu, your user account may not have the action permission for it or the *Text Import* feature was not included in your GCAS licence. Contact your GCAS administrator.



Load the data source file and select the appropriate importer module. The *importer module* depends on the format of the file. For example, GCAS Desktop supports legacy Daniel report files, Daniel 370XA files, and Daniel 700XA files. These three report files have different formats and are not compatible to one another, therefore we include three Daniel importer modules to handle each of them.



The required files look similar to the screenshots below.

C7_Complete Cal1.txt - Notepad

File Edit Format View Help

```
                              Final Calibration

Date-Time: 01/02/12 08:50   Analysis Time: 350    Cycle Time: 365
Stream: 1  Stream 1         MODE:  FCAL     Cycle Start Time: 07:44
Analyzer: TEST4             Strm Seq:2
Company: Daniel Industries


   Component       Cal      Old RF      New RF    * RF %  Old RT New RT * RT %
      Name        Conc.                             DEV.                  DEV.
n-HEPTANE         252 PPM  2.36633e+7  2.35721e+7 * -0.39   29.1   29.0 * -0.17
PROPANE          10.0450  1.39098e+7 1.3914e+007 *  0.03   57.3   57.3 *  0.00
i-BUTANE          0.5904  1.65627e+7  1.65654e+7 *  0.02   75.2   75.2 *  0.00
n-BUTANE          1.5948  1.70249e+7  1.70353e+7 *  0.06   82.9   82.9 *  0.06
NEOPENTANE        489 PPM  1.77465e+7  1.77484e+7 *  0.01   98.9   99.0 *  0.10
i-PENTANE         0.1010  1.87067e+7  1.86758e+7 * -0.17  122.8  122.9 *  0.04
n-PENTANE         0.1000  1.93425e+7  1.93493e+7 *  0.04  135.4  135.4 *  0.00
C6's              481 PPM  2.05328e+7  2.06192e+7 *  0.42  252.7  252.7 *  0.00
NITROGEN           5.0490 7.9287e+006 7.9364e+006 *  0.10  266.9  266.9 * -0.02
METHANE           71.7970  6.52073e+6  6.527e+006 *  0.10  271.4  271.4 *  0.00
CARBON DIOXIDE     0.9950  9.29266e+6  9.29899e+6 *  0.07  303.0  303.3 *  0.10
ETHANE             9.6010  1.03907e+7  1.04043e+7 *  0.13  325.0  325.3 *  0.09


ACTIVE ALARMS
None
```

Ln 5, Col 29

Example of calibration data generated by Daniel GC (legacy format)

NGC Calibration 1.txt - Notepad

File Edit Format View Help

```
      Totalflow Laptop Current Results Report                          page 1
      Printed date: 04/05/2013

      Station ID: MyDevice
      Device ID : 1ST CAL                  Location:       Location of 1st Cal

      SYSTEM:                                  STATE:
      LEASE:                                   PRODUCER:
      OPERATOR:                                BUYER:



      Results Date/Time          04/05/2013 12:39
      Stream Number              Calibration
      Manifold Temp              65.260 (deg C)
      Oven Temp                  62.541 (deg C)
      Calculation Type           ISO-6976-1995
      Stream Application Rev     2103507-007
      Metrology Control Number   2103313-001
      Flash Software Part Number 2102411-029
      Contract Pressure          101.696 (kPa)
      Contract Temp              18.000  (deg C)
      Carrier Pressure(1)        102.211 (kPag)
      Carrier Pressure(2)        97.128  (kPag)
      Sample Pressure            60.030  (kPag)

      Comp               Response  UnNorm%   Norm%    P Area     P Height   P Time   Liquids   Ideal     Rel. Den.
                         Factor                                                (liter/m3)(MJ/m3)
      ------------------------------------------------------------------------------------------------------------
      Propane            2.4962    2.0035    2.0196   7431022    73606      50.23    0.0742    1.897     0.0308
      Hydrogen Sulfide   0.0166    0.0051    0.0052   2058914    9353       93.25    0.0000    0.001     0.0001
      IsoButane          2.1454    0.2202    0.2220   870678     7436       73.05    0.0097    0.270     0.0045
      Butane             9.0481    0.2009    0.2025   828785     6196       82.15    0.0085    0.247     0.0041
      NeoPentane         0.0000    0.0000    0.0000   0          0          0.00     0.0000    0.000     0.0000
      IsoPentane         0.3301    0.1605    0.1618   801550     3772       142.30   0.0079    0.242     0.0040
      Pentane            1.5647    0.1407    0.1419   719214     2999       166.28   0.0069    0.212     0.0035
      Hexane+            0.2098    0.0994    0.1002   574969     6310       24.00    0.0055    0.178     0.0030
      Nitrogen           4.1338    0.4102    0.4135   1107150    13330      40.23    0.0000    0.000     0.0040
      Methane            1.1470    85.7086   86.3987  179694297  668439     48.20    0.0000    32.578    0.4786
      CarbonDioxide      1.1365    3.2844    3.3108   10598613   45659      88.20    0.0000    0.000     0.0503
      Ethane             0.9218    6.9677    7.0238   25259164   51156      204.32   0.2506    4.640     0.0729
      Hexane             0.0000    0.0000    0.0000   0          0          0.00     0.0000    0.000     0.0000
      Heptane+           0.0000    0.0000    0.0000   0          0          0.00     0.0000    0.000     0.0000
      Heptane            0.0000    0.0000    0.0000   0          0          0.00     0.0000    0.000     0.0000
      Octane             0.0000    0.0000    0.0000   0          0          0.00     0.0000    0.000     0.0000
      Nonane+            0.0000    0.0000    0.0000   0          0          0.00     0.0000    0.000     0.0000
```

Example of calibration data generated by ABB GC

Text import will import one record at a time. The device tag name in the text file must match the device name (tag) in GCAS database. The device tag name is the "`Analyzer`" in Daniel GC report file, or "`Station ID`" in ABB GC report file.

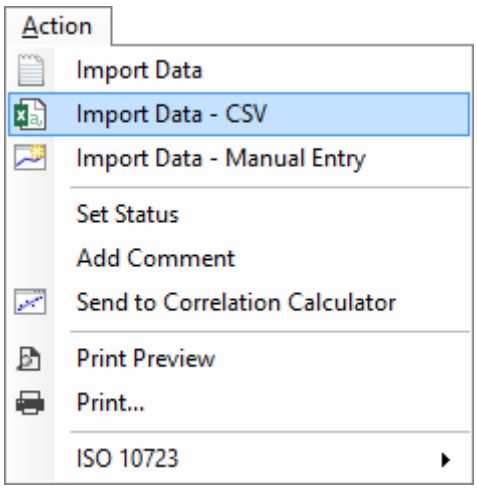
7.4.2 CSV Import

Should you wish to upload multiple records in one go *or* if your GC device was not manufactured by Daniel Industries nor ABB, you would need to use CSV import.

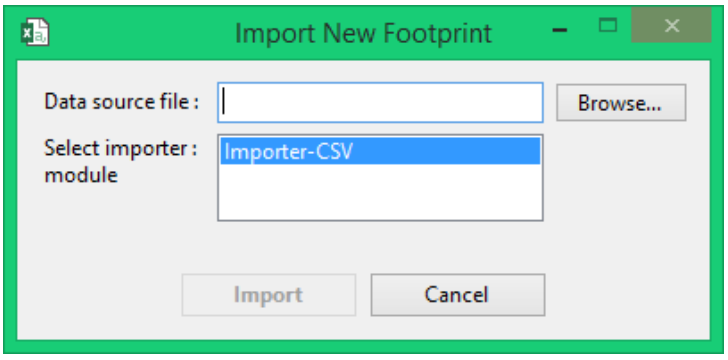
The CSV spreadsheet must follow the template to be recognised by GCAS Desktop (see warning box below). The template defines column allocation within the spreadsheet. Failure to comply with this template will result in wrong data being associated with wrong gas or component.

CSV file template should be inside your installation directory. The default directory is `C:\GCAS`. Look for `CSV import file template.zip` in that folder. If you lose this template, you can easily recreate new one by following the guide in the information box at the bottom of this chapter.

When you are ready to import the CSV file, open the Action menu and choose **Import Data - CSV**.



Load the CSV file and click **Import**. GCAS Desktop has only one CSV importer module.



Likewise if you do not see this menu, your user account may not have the action permission for it or the *CSV Import* feature was not included in your GCAS licence. Contact your GCAS administrator.

Lost your template?

GCAS Desktop has two CSV templates, one is for footprint and calibration data import while the other is for mole composition import. For footprint/calibration data import, the column assignments are:

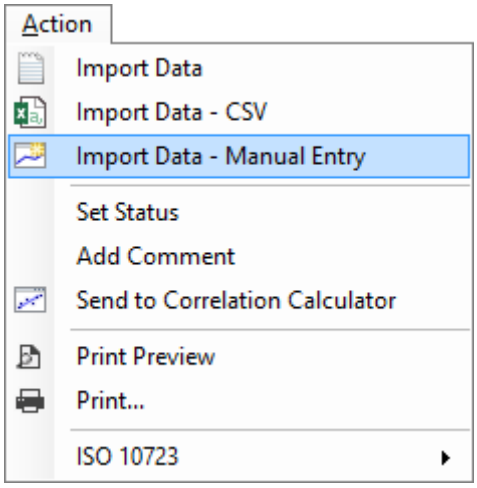
Column	Excel name	Description
1	A	Device tag name. (Yes, you can import data for multiple devices in one go.)
2	B	Record flag. Fill **1** for footprint or **2** for calibration data.
3	C	Record timestamp in the format of **dd/mm/yyyy hh:mm** (24-hour clock).
4	D	Methane response factor.
5	E	Nitrogen RF.
6	F	Carbon dioxide RF.
7	G	Ethane RF.
8	H	Propane RF.
9	I	i-Butane RF.
10	J	n-Butane RF.
11	K	Neopentane RF. If your device doesn't read neopentane, fill in **0** (zero).
12	L	i-Pentane RF.
13	M	n-Pentane RF.
14	N	Hexane RF.
15	O	Heptane RF. If your device doesn't read heptane, fill in **0** (zero).
16	P	Octane RF. If your device doesn't read octane, fill in **0** (zero).
17	Q	Nonane RF. If your device doesn't read nonane, fill in **0** (zero).
18	R	Decane RF. If your device doesn't read decane, fill in **0** (zero).
19	S	Is it multilevel-calibrated RF? Fill **0** for single-point or **1** for MLC. If you don't have *ISO 10723* in your licence, **always fill 0** (zero).
20	T	Methane retention time.
21	U	Nitrogen RT.
22	V	Carbon dioxide RT.
23	W	Ethane RT.
24	X	Propane RT.
25	Y	i-Butane RT.
26	Z	n-Butane RT.
27	AA	Neopentane RT. If your device doesn't read neopentane, fill in **0** (zero).
28	AB	i-Pentane RT.
29	AC	n-Pentane RT.
30	AD	Hexane RT.
31	AE	Heptane RT. If your device doesn't read heptane, fill in **0** (zero).
32	AF	Octane RT. If your device doesn't read octane, fill in **0** (zero).
33	AG	Nonane RT. If your device doesn't read nonane, fill in **0** (zero).
34	AH	Decane RT. If your device doesn't read decane, fill in **0** (zero).

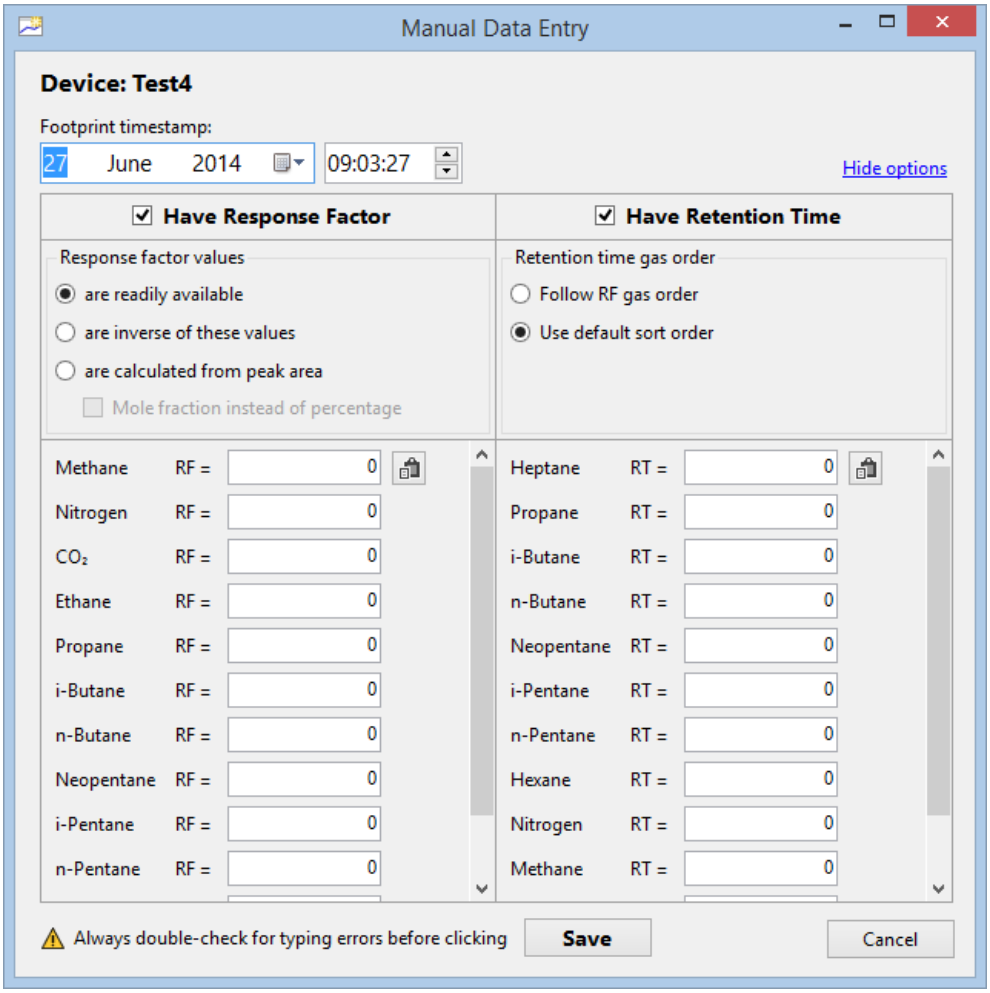
In case your GC device does not provide RF data at all, or no RT data at all, set all RF values or RT values to **-1** (negative one). This will cause GCAS Desktop to regard these data as incomplete footprint or calibration data. RF or RT chart will not be rendered instead of being graphed as all-zeroes.

7.4.3 Manual Entry

Aside from text and CSV import, you also have an option to enter the RF and RT values by hand. Manual entry also provides additional options to accommodate some GC devices which calculate RF value using the inverted formula (i.e. mole percentage divided by peak area) or GC devices providing only the data of peak area. Nevertheless, this method is the least recommended way to import data because it is very suspectible to human error.

Open the action menu and select **Import Data - Manual Entry**. This menu displays the *Manual Data Entry* form. If you do not see this menu, your GCAS user account may not have the action permission for manual entry or your GCAS licence does not include *Manual Data Entry*. Contact your GCAS administrator.





First things first, set the footprint or calibration timestamp accordingly. Next you can begin entering RF and RT values in the available input fields.

If your footprint or calibration data does not have retention time data, untick **Have Retention Time**. This will disable all RT input fields. Similarly, if you do not wish to enter RF values, untick **Have Response Factor**. Read more about incomplete footprint or calibration data.

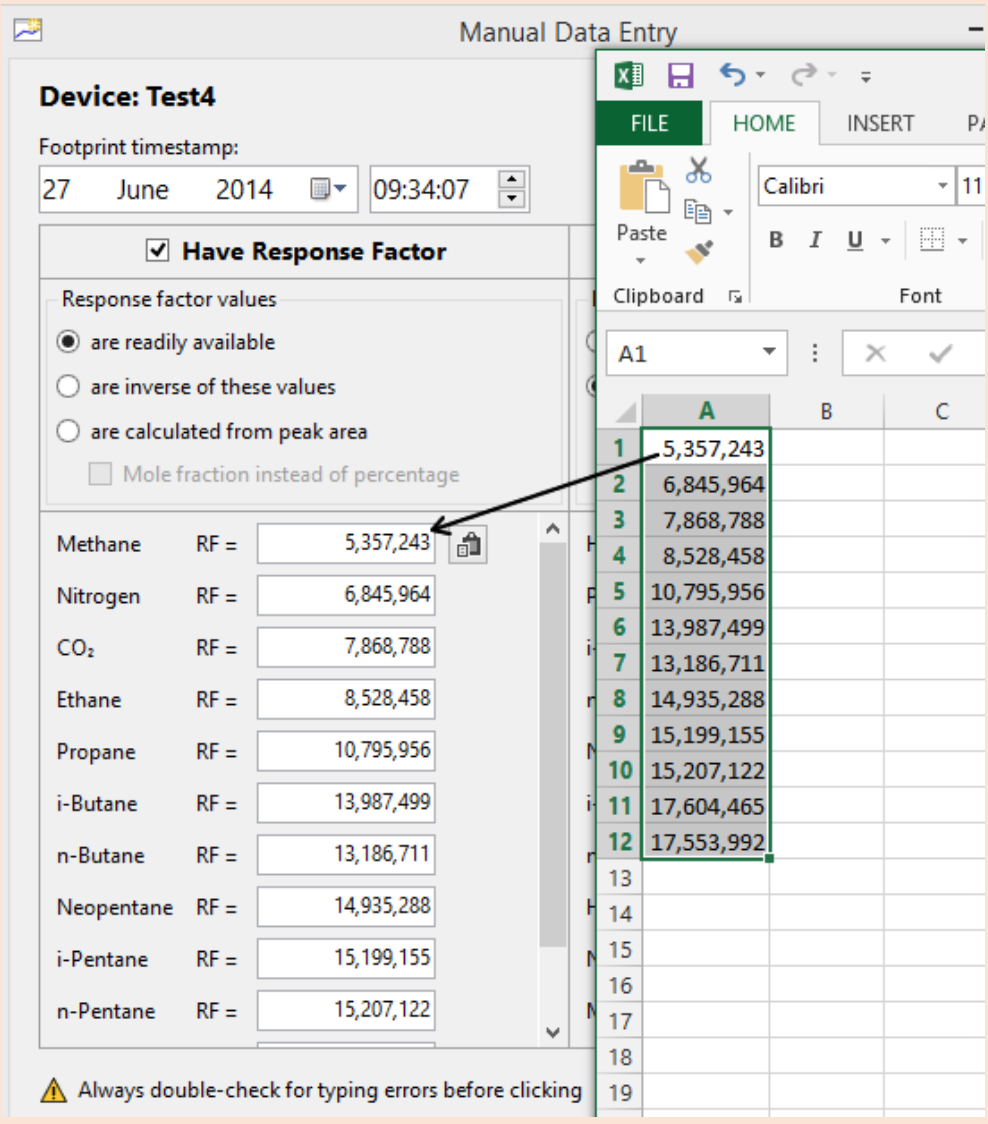
Response factor input has three options, described below.

- **Response factor values are readily available**: RF data is the values you entered.
- **Response factor values are inverse of these values**: RF data is calculated from the reciprocal of the values you entered. If you type `1.567E-7` for example, the RF value will be $1 / 1.567 \times 10^{-7}$, which is 6,381,621 (rounded). Use this option if your GC device uses the inverted formula, that is mole percentage divided by peak area.
- **Response factor values are calculated from peak area**: This option shows two input fields for every gas. First input field is for peak area as given by your GC device. Second input field is for mole percentage, as in the component data table or calibration gas certificate. RF values are then calculated using the formula peak area divided by mole percentage.
    - **Mole fraction instead of percentage**: This option changes mole percentage input into mole fraction. GCAS Desktop will convert mole fraction back into percentage at later stage.

Retention time input has two options, and both are related to its gas order. To make RT input fields use the same gas order as RF input fields, choose **Follow RF gas order**. This is particularly useful if you want to paste the numbers from your spreadsheet (see tip box below) but the gas order in your spreadsheet is different from the default sort order.

Tip

You can copy numbers from Microsoft Excel or other spreadsheet processing software. Press `Ctrl+V` on the **first text box** and the rest will follow. Alternatively, click **Paste** next to the corresponding input field series.



Click **Hide options** link near the the top-right corner to hide both option panels and to make larger room for the input fields.

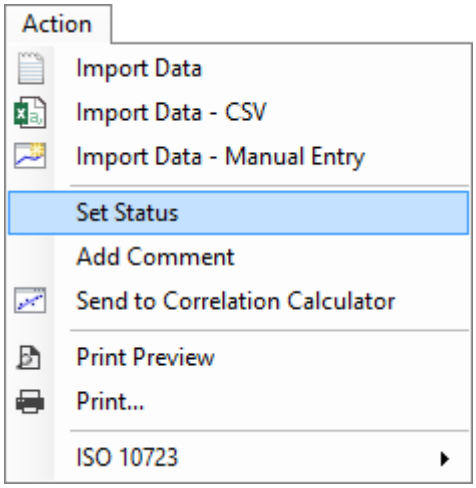
Always check the numbers — and also the timestamp — before you click **Save**. Once it is saved, the record is not editable.

7.5 Change Record Flag and Status

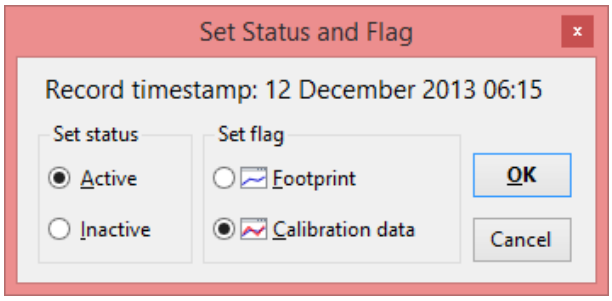
7.5.1 Change Record Flag

Footprint and calibration data share the same record structure in database, distinguished by a flag. This flag can be changed from *footprint* to *calibration data* and vice versa. To change this flag, do the following.

1. From an open Footprint or Calibration Data form, go to Action menu > **Set Status**. If you do not see this menu, your user account may not have the action permission for it. Contact your GCAS administrator.

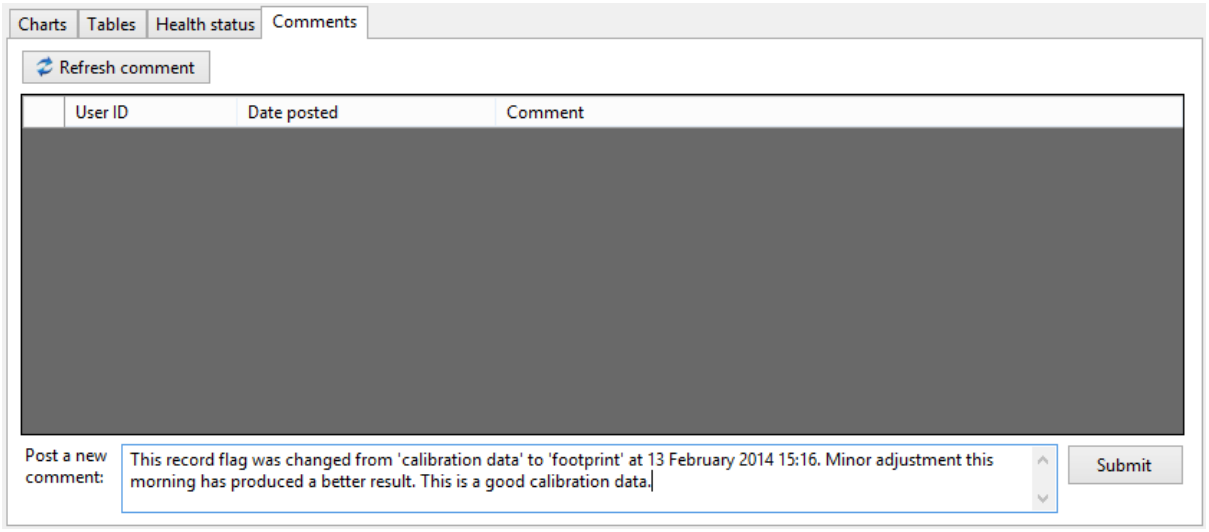


2. This will show *Set Status and Flag* dialogue.



3. Choose one of the options in **Set flag** group, whether to set the record as a footprint or as a calibration data. Click **OK** to commit the change.
4. Notice that the record is reloaded using the other form. That is, for footprint it will be reloaded using Calibration Data form, and for calibration data it will be reopened using Footprint form.
5. The **Comments** tab opens automatically and it is advised to write a comment of why the record flag was changed. Comments tab will not open in case your GCAS user account doesn't have

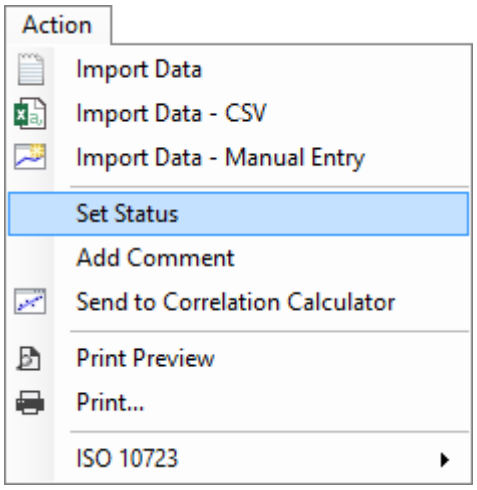
action permission to post comments.


Charts
Tables
Health status
Comments
Refresh comment
User ID
Date posted
Comment
Post a new comment:
This record flag was changed from 'calibration data' to 'footprint' at 13 February 2014 15:16. Minor adjustment this morning has produced a better result. This is a good calibration data.
Submit

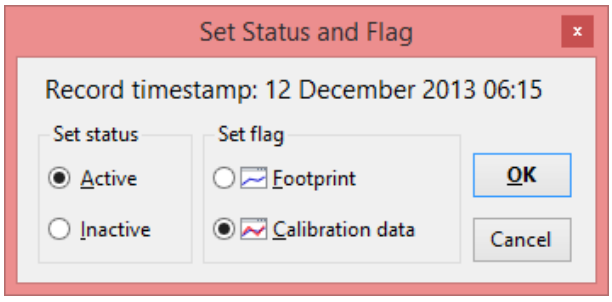
7.5.2 Change Status

Every footprint or calibration record has a status bit that can change from active to inactive or vice versa. Inactive records will not be included in data analysis therefore will not affect the calculation of mean and standard deviation in data analysis. Below are the steps to mark records as inactive or active.

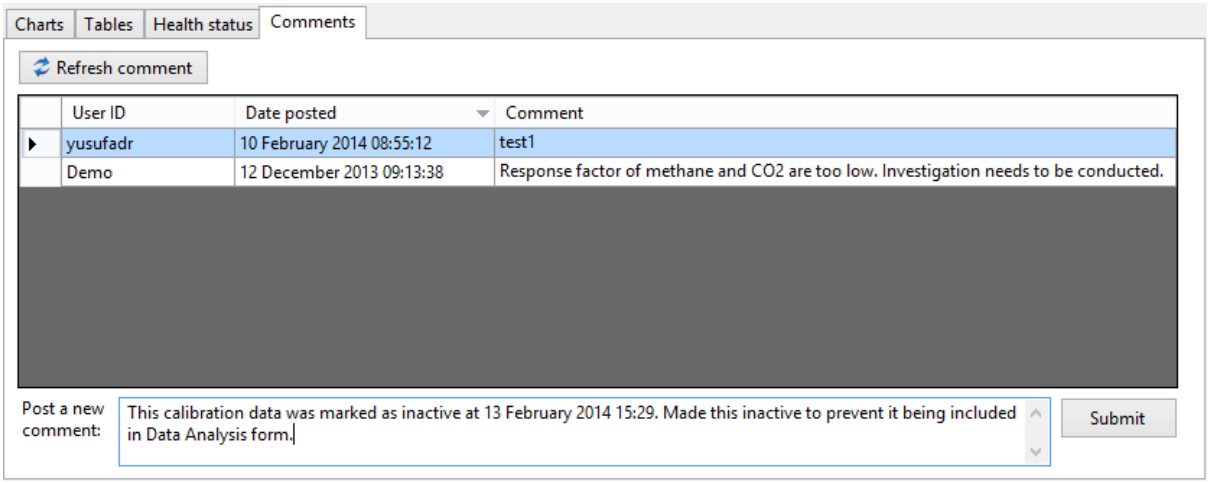
1. From an open Footprint or Calibration Data form, go to Action menu > **Set status**. If you do not see this menu, your user account may not have the action permission for it. Contact your GCAS administrator.



2. This will show *Set Status and Flag* dialogue.



3. Choose one of the options in **Set status** group, whether to mark this record as active or inactive. Click **OK** to commit the change.
4. The form will reload the record and you should see the new status on the top section. Next, the **Comments** tab opens automatically and it is advised to write a comment of why the record status was changed. Comments tab does not open if your GCAS user account doesn't have action permission to post comments.



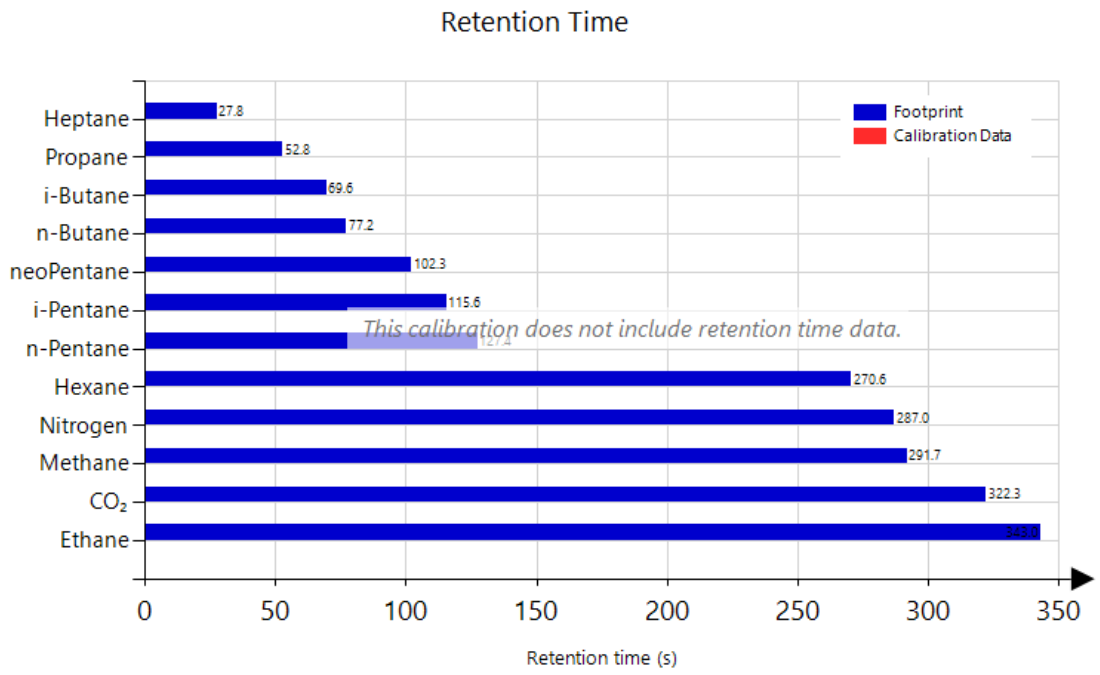
7.6 Incomplete Footprint or Calibration Data

There are cases of *incomplete* footprint record or incomplete calibration data. A footprint or calibration record is said to be *incomplete* if it has only response factor data, or only retention time data, *but not both*. Incomplete records usually come from data capture operation but with additional configuration to ignore RF data or ignore RT data.

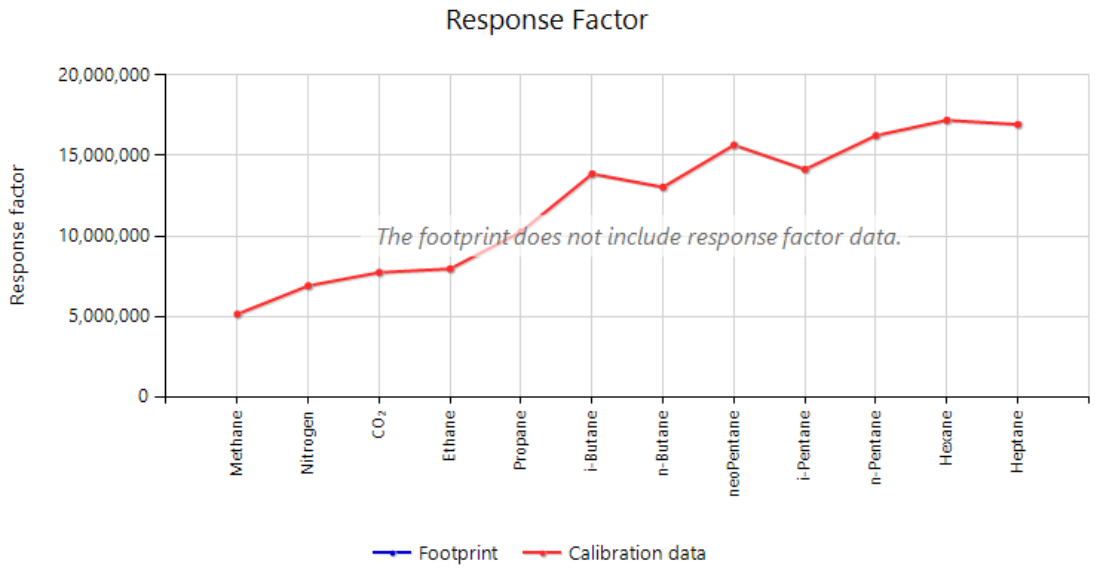
If GCAS Desktop was instructed to ignore RF data, it assigns the special value **−1** (negative one) to all RF values. The same goes for RT, which GCAS Desktop assigns −1 to all RT fields. You shall see this special −1 value when you switch to table view on either Footprint or Calibration Data form.

Why −1? This value is used to differentiate the **0** (zero) value, which indicates the gas is missing or not present in the calibration inlet. By default, GCAS Desktop will still plot zero values on RF or RT chart, but not the −1's. You can override this behaviour by starting GCAS Desktop with an additional **/drawincompleteRFRT** parameter.

When you view an incomplete record, its response factor chart or retention time chart will display a text annotation on top of itself. For example,

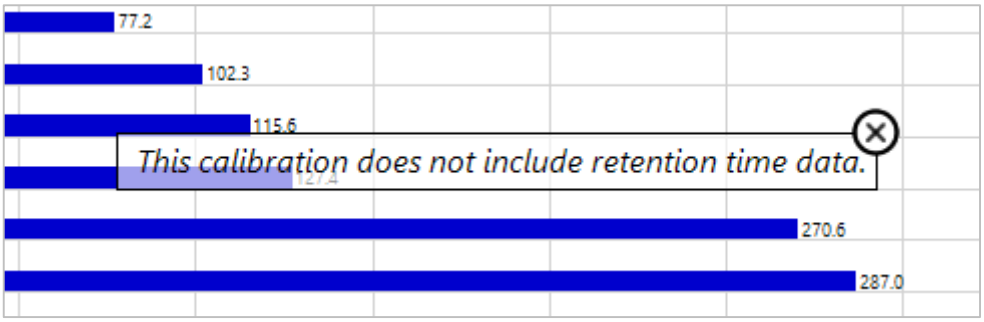


In the screenshot above, the calibration record does not have retention time data. You only see blue bars (footprint), but red bars (calibration) are missing. Another example,



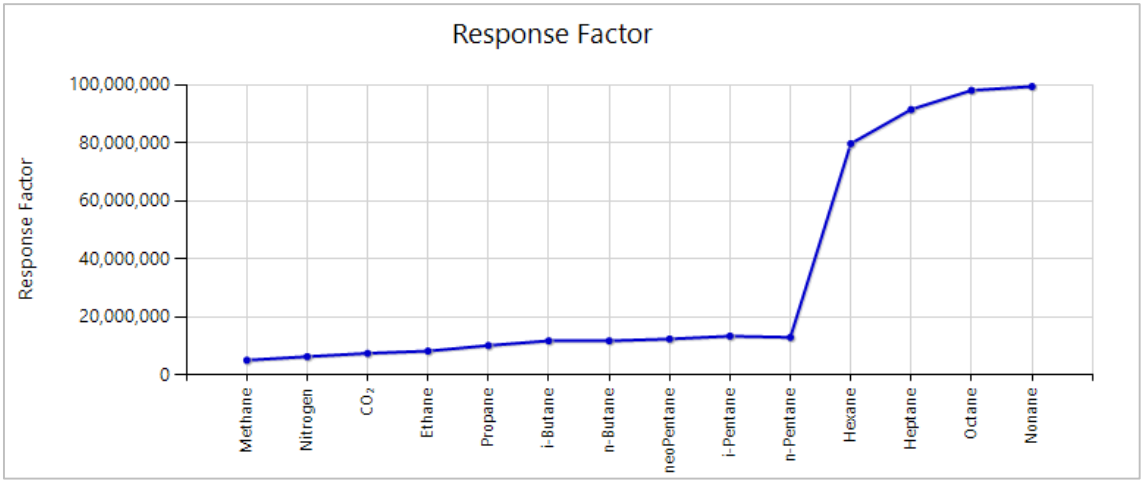
...the calibration record has RF data but its footprint does not. You only see red line (calibration) but blue line (footprint) is missing. The chart displays annotation that the footprint does not have RF data.

If you are on Calibration Data form, the annotation may obscure part of the chart. Click once on the annotation to reveal the ⊗ close icon. Click again on the ⊗ close icon to remove the annotation. (Footprint form does not have this feature.)



7.7 Zoom and Scroll (RF Chart Only)

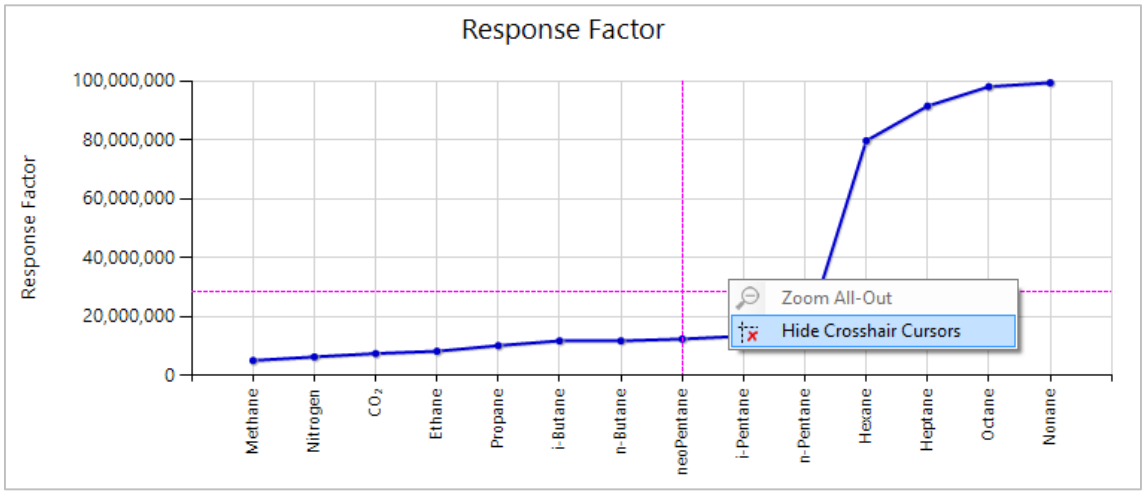
Daniel C9+ and C10+ devices have a distinctive characteristic on their RF charts: The line chart rises slowly, but suddenly jumps to a much higher number starting at the first gas being detected by the second detector.



In order to zoom a part of this chart, drag a rectangle on the area you would like to zoom in.
Use the scroll bars to pan the zoomed chart.
To zoom in further, drag another rectangle area.
To zoom out, either click both circled minus buttons Θ or right click on the chart then select **Zoom All-Out**.



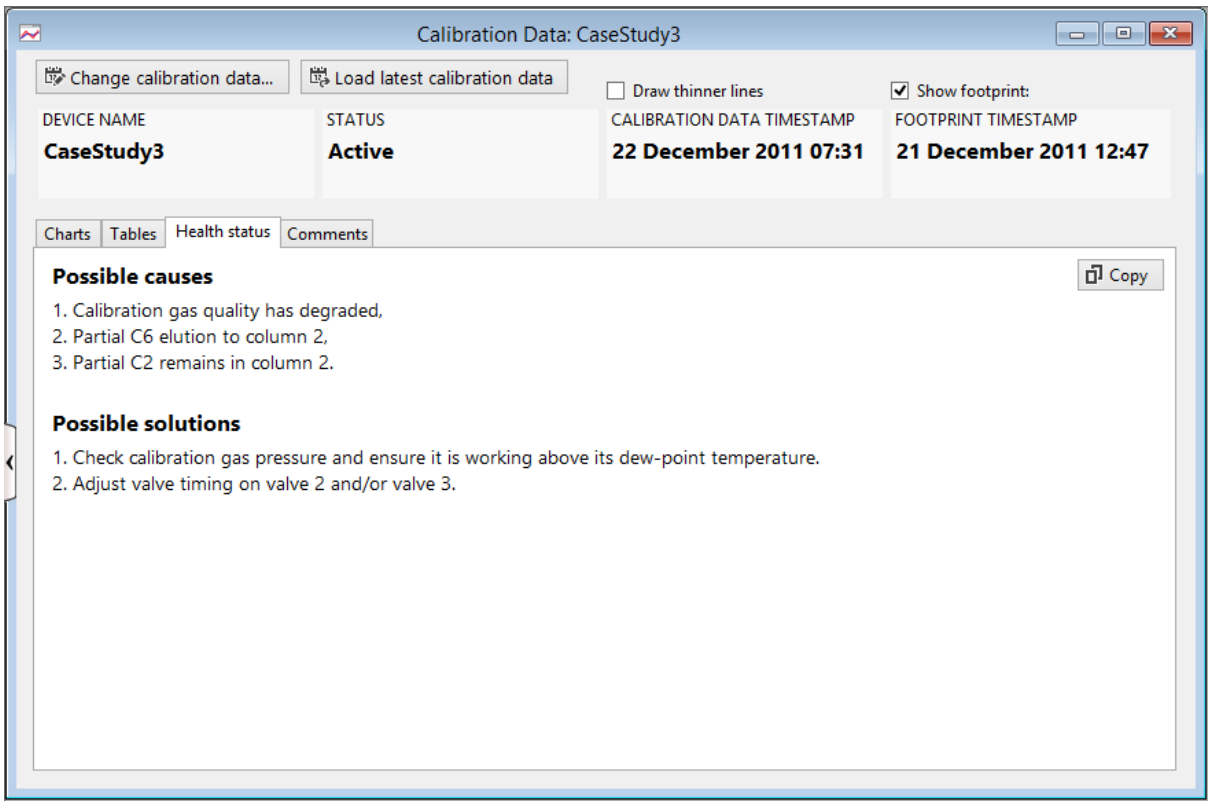
The *crosshair cursor* is the dotted magenta line which appeared when you click anywhere on the chart region or as a remnant of a zoom operation. These lines may act as a ruler or guide. To remove these lines, right click on the chart and select **Hide Crosshair Cursors**.



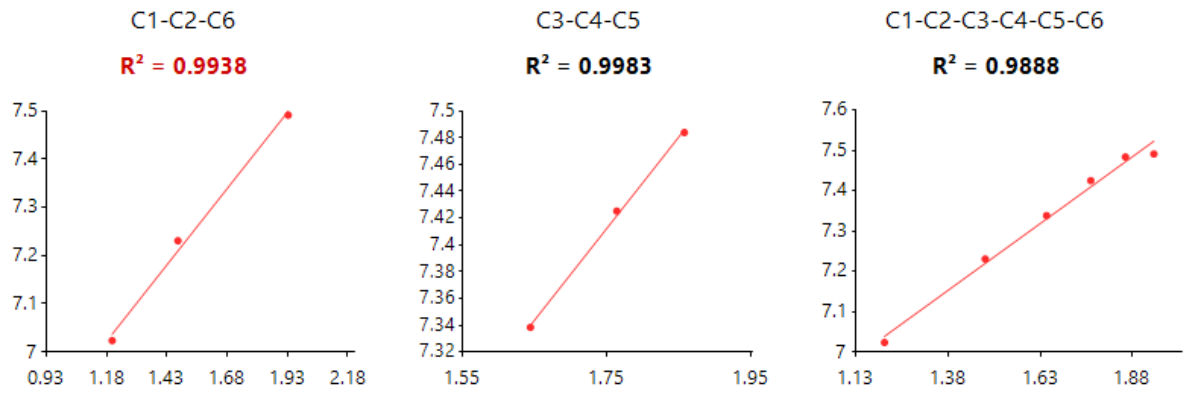
7.8 GC Health Status

GCAS Desktop may suggest an action should you see a fail alarm, which is R^2 (correlation) value is below the defined threshold. For the time being, this feature is only available for Daniel C6+ and C7+ GCs.

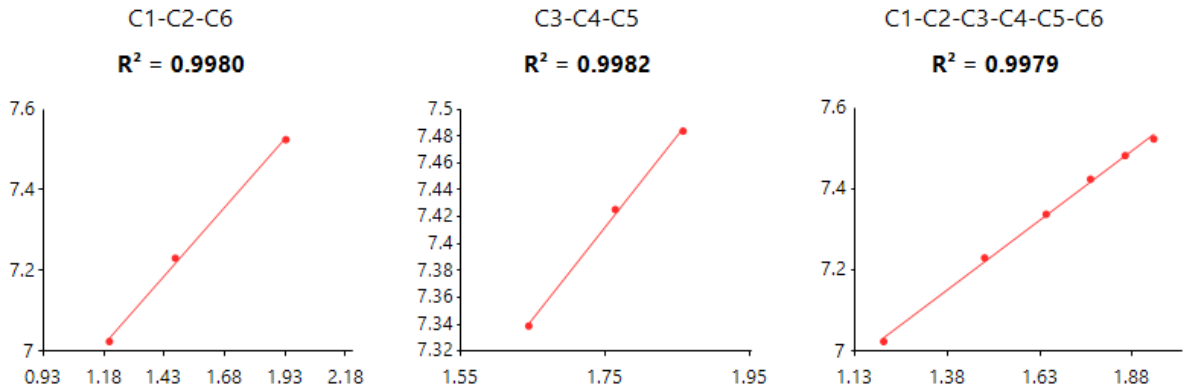
Go to the **Health status** tab on either Footprint form or Calibration Data form. In the example below, the correlation value of light-and-heavy components (methane, ethane, hexane) happened to be under the threshold.



Let's take a detour to the RF-MW charts. Here we see the R^2 (correlation) value of C1-C2-C6 is short under the threshold of 0.995. By looking at the third chart, we see that C6 is below the trend line. Hexane is lower than where it should be.



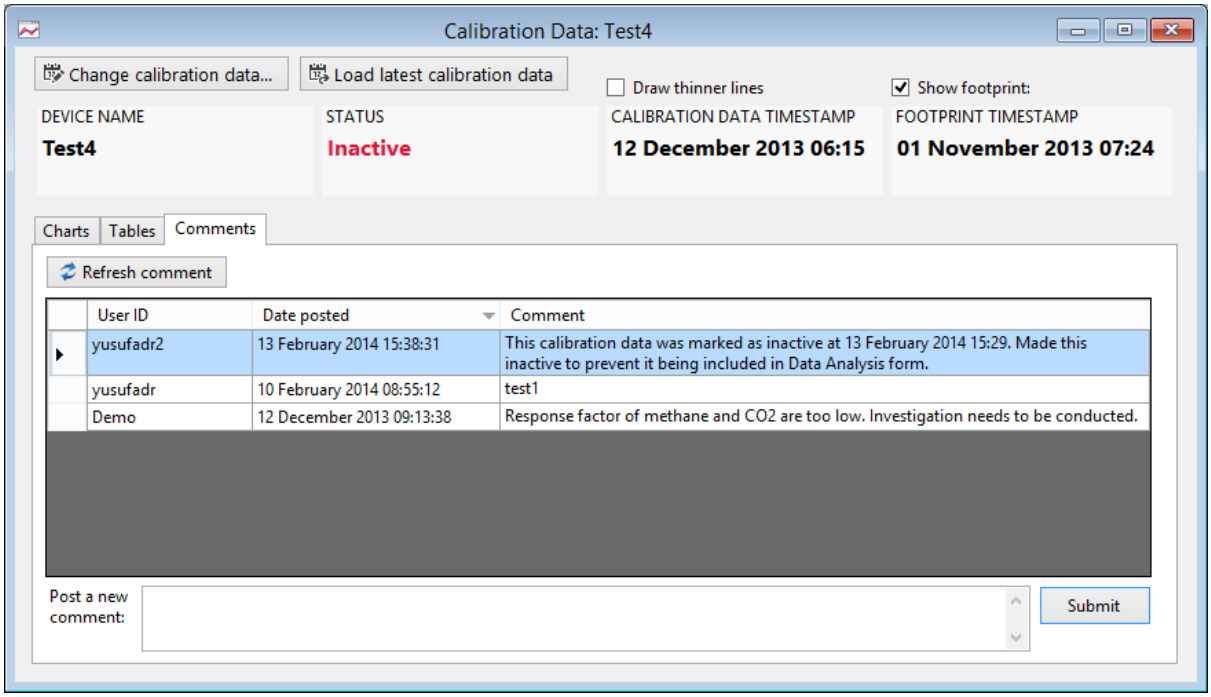
We can infer that the hexane backflush stage is late, so that a part of hexane eluted to the second column. To achieve the goal in this example, we need to adjust the timing of valve 2 to close a bit faster. After making such adjustment, we have a good correlation on the next calibration cycle:



GC health status is only available for Daniel C6+ and C7+ devices. Method of suggestion based on R^2 values for Daniel C9+, Daniel C10+, and ABB GCs is currently not available.

7.9 Insert Comment

Users can comment on a record. It is useful to write comments when an action is being done onto GC device, or in case of unexpected behaviour has occurred. You are also taken to the comment section automatically whenever record property is changed (either record flag or record status). It is a good practice to provide explanation on why the record property was changed.



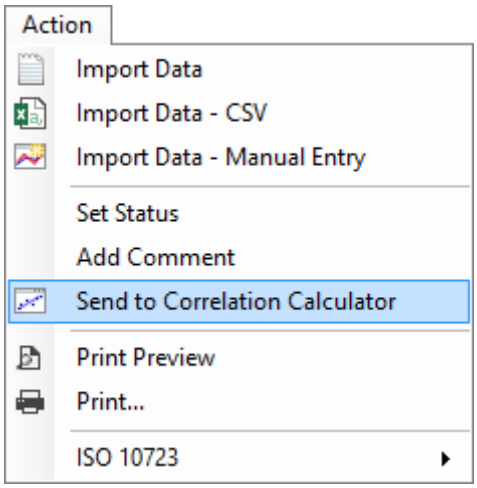
1. To insert comment, open the **Comments** tab or go to Action menu > **Add Comment**.
2. Write your comment on the text box at the lower section of the form then click on **Submit** button.

3. Make sure the comment is correct (e.g. free from spelling errors) because once inserted into database, you will not be able to remove the comment. This is a part of the requirement for audit trail.

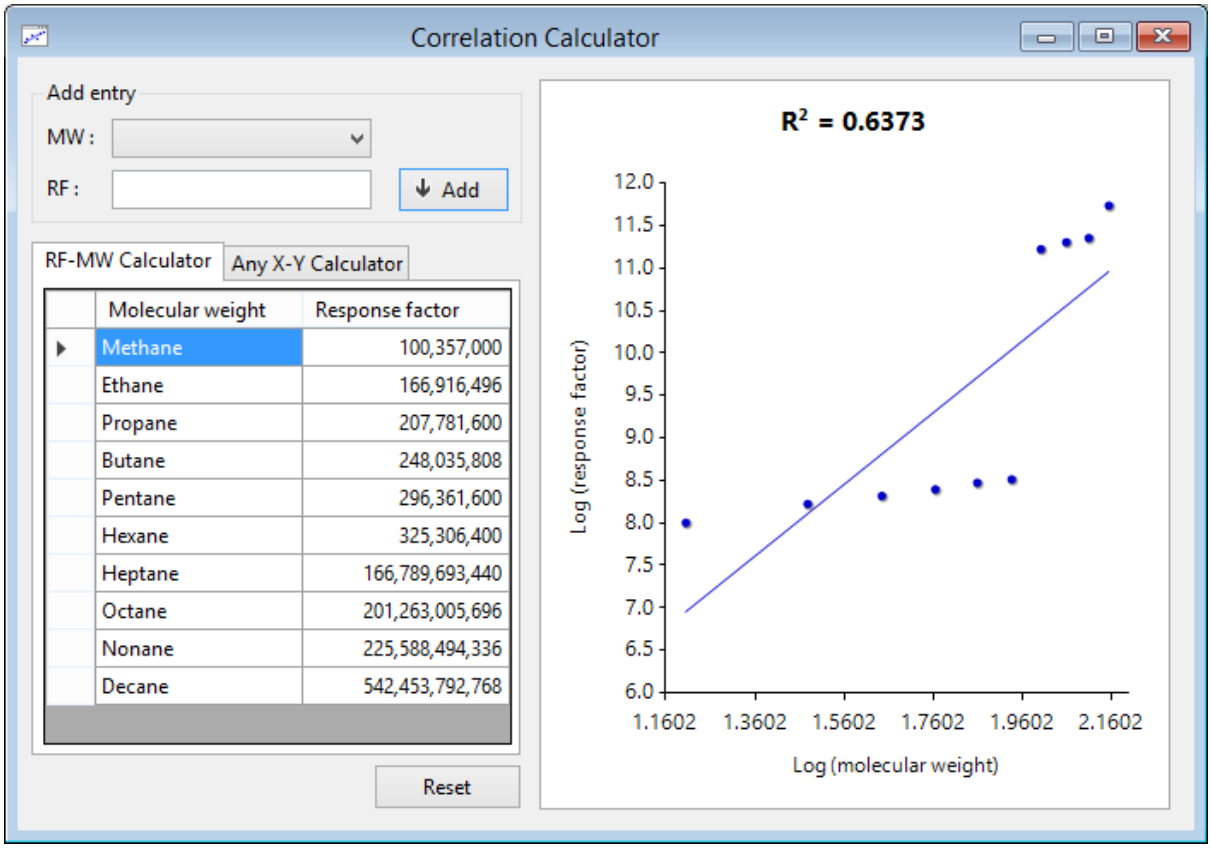
If you do not see the textbox and the Submit button, i.e. the comment grid fills up the entire form, your user account may not have action permission to write comments or your user role is *Read-only*. Contact your GCAS administrator.

7.10 Send to Correlation Calculator

This shortcut is intended for unsupported GC or those in special needs. For example, your GC is C10+ complete, is actually calibrated with C10 calibration gas (decane is present). But later on, your process gas is only up to C9 (decane is missing). This will mess up the correlation calculation (R^2) because the response factor of decane is zero. To workaround this problem, open the Action menu from an open Footprint or Calibration Data form, then select **Send to Correlation Calculator**.



This menu will send all response factor values from methane (C1) to decane (C10) to Correlation Calculator. Only normal butane and normal pentane are included, their isomers are not. Once the Correlation Calculator form is open, simply delete any unwanted gases and the calculator will get you the correct R^2 result. In our example before, C10+ device treated as C9+ should have R^2 of C6-C7-C8-C9, not C7-C8-C9-C10. In Correlation Calculator form, delete methane, ethane, propane, butane, pentane, and decane; this will give you the correlation of hexane, heptane, octane, and nonane. Visit chapter 18 to read more about correlation calculator.



Correlation Calculator with data sent from Footprint or Calibration Data form. Delete unwanted gases to get the correct R^2 result. For example, to get the correlation of C7-C8-C9-C10, delete everything from methane to hexane.

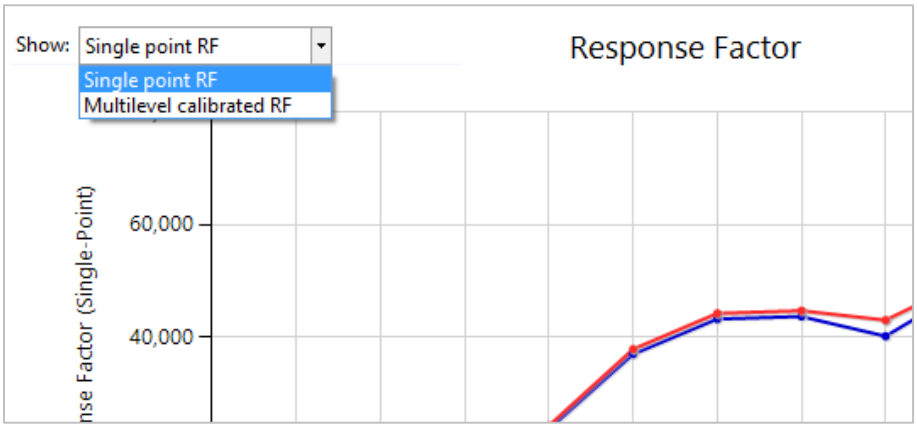
7.11 Multilevel-Calibrated RF (ISO 10723)

GCAS Desktop supports the traditional single-point response factors as well as multilevel-calibrated (MLC) response factors.

Note

This feature requires *ISO 10723* feature in your GCAS licence.

Users with *ISO 10723* feature in their licences will see MLC selector at top-left region of response factor chart. This dropdown list lets you change the displayed RF whether the single-point or the MLC one. GCAS Desktop performs ISO 10723 conversion on-the-spot, therefore the actual RF values in the database are not affected. By default, GCAS Desktop displays single-point RF.

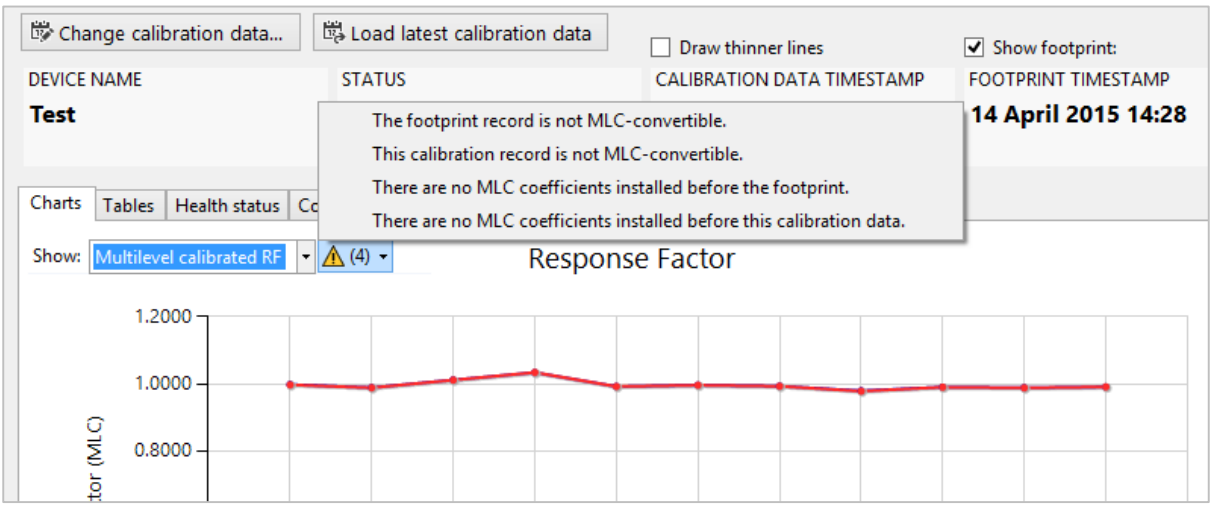


Single-point RF has the familiar graph as discussed so far, it has to be ascending and the values are in the range of millions to hundreds of millions. However multilevel-calibrated RF is different: All values are close to one (1.0), therefore its chart is somewhat horizonally flat. Multilevel-calibrated RF has no much use as it is not usable for correlation calculation, but you can easily detect anomalies if the chart is not flat.

ISO 10723 conversion for footprint/calibration data requires:

1. A multilevel calibration (MLC) coefficient set installed before the timestamp of the footprint/calibration record, and
2. An active calibration gas certificate installed before the timestamp of the footprint/calibration record.

If these two conditions are not met, the footprint or calibration record is said to be *not convertible*. For calibration data, these conditions must be fulfilled for *both* the calibration record itself and the preceding footprint. GCAS displays a ⚠ warning icon next to the MLC dropdown selector if your footprint or calibration data is not convertible; also if the calibration data is convertible but its preceding footprint isn't. In the latter case, the MLC coefficients are between the footprint and calibration record timestamp. Click on the warning icon to see the detailed reason why the record is not convertible.



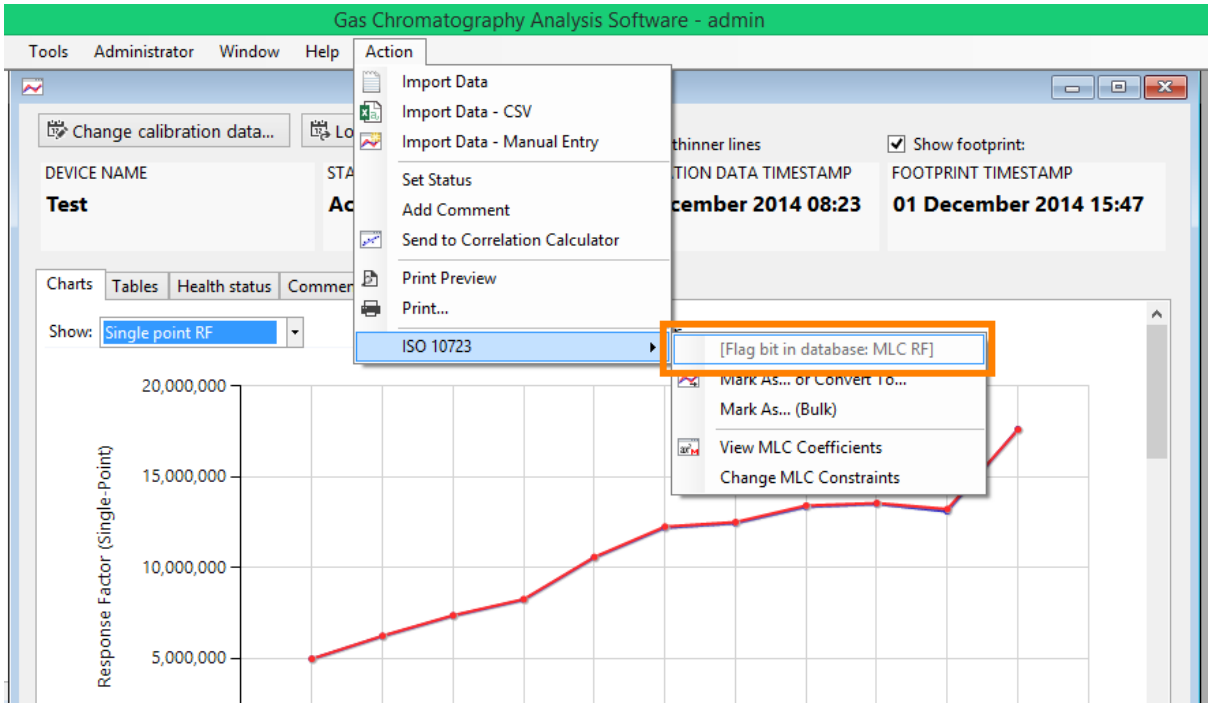
MLC conversion warning icon.

To see the MLC coefficients associated with current record, open the Action menu, select **ISO 10723**, then click **View MLC Coefficients**. This menu calls Multilevel Calibration Coefficients form and loads the correct coefficient set associated with current footprint or calibration data.

7.11.1 MLC Flag Bit

Footprint and calibration records have an additional flag bit to indicate whether the RF values are single-point or multilevel-calibrated. If you don't have *ISO 10723* feature in your licence, this flag bit is always set to single-point. To recap, footprints and calibration data have three flag bits: One to indicate active/inactive, another one to indicate whether it is a footprint or calibration data, and the last one to indicate whether its RF are single-point or MLC.

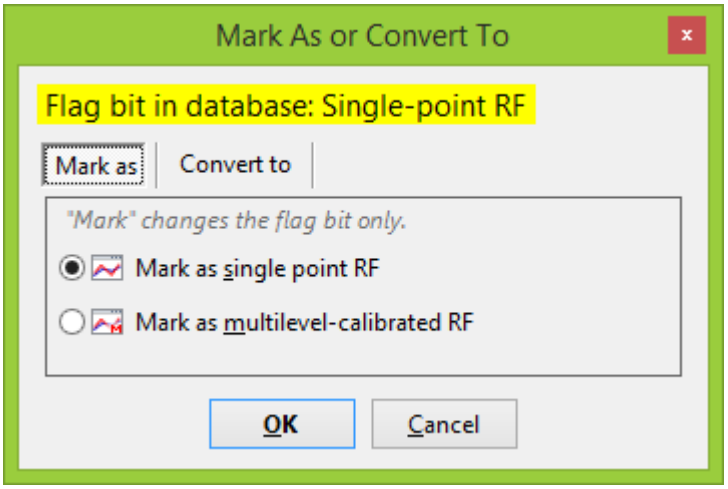
Open the Action menu and select ISO 10723. The first submenu is not clickable but it tells you what the flag bit of current record is. In the screenshot below, it tells us the flag bit for this record is MLC, even though RF chart displayed at the back is single-point.



You can change the MLC flag bit if necessary, however there is one important difference between "Mark As" and "Convert To". Read more on the next chapter, 7.11.2.

7.11.2 Mark As versus Convert To

Open Action menu, select **ISO 10723**, then select **Mark As... or Convert To...** and GCAS Desktop reveals this dialogue box.



Current flag bit is highlighted in yellow to clarify what the current flag bit is. Next, decide whether you need to *mark* the flag bit or *convert* the whole record.

Mark As changes the flag bit only. The original numbers of all RF values are untouched. Use this if you notice:

- MLC selector shows "single-point" but the chart is horizontally flat and all numbers are close to one (1.0). Also when the selector is changed to multilevel-calibrated, the chart is still flat and all numbers become almost zero. You need to **mark** the record **as** MLC.
- MLC selector shows "multilevel-calibrated" but the chart is not horizontally flat and instead the numbers skyrocket to scale of hundreds of billions or even trillions. Also when the selector is changed to single-point, the chart suddenly forms a nice ascending shape and the numbers now make sense. You need to mark the record as single-point.

Convert To changes the flag bit *and* converts all RF values, thus changing the actual numbers stored in database—permanently. Use this when you see the record is **good** (the numbers make sense), which is completely opposite condition of when to use *Mark As*.

Because *Convert To* also converts the actual RF values, you will get the desired numbers during data export. For example, you want to export footprint/calibration data into CSV. All records are marked as MLC. If you go to export directly, all RF values in the result CSV will also be close to one (1.0) as they were in MLC. On the contrary if you use *Convert To* single-point before the export, RF numbers will be in scale of millions like typical single-point RF values.

Unlike *Mark As*, the *Convert To* operation requires action permission "MLC permanent conversion". If your GCAS administrator doesn't give you this permission, GCAS displays a message saying that you don't have sufficient permission to perform conversion when you select *Convert To* in this dialogue box.

Important

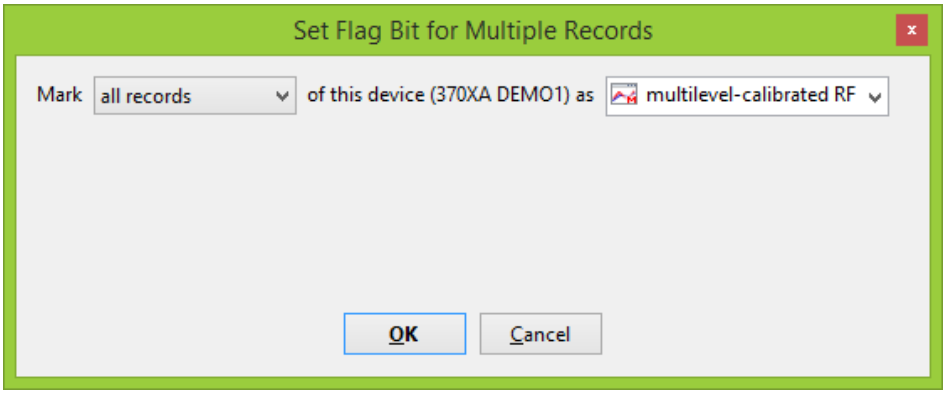
Be very cautious when using *Convert To*. Performing permanent conversions on wrong record will damage the record permanently. For instance, a calibration record is wrongfully marked as single-point where it should've been marked as MLC. You should use *Mark As* MLC here. But if you apply

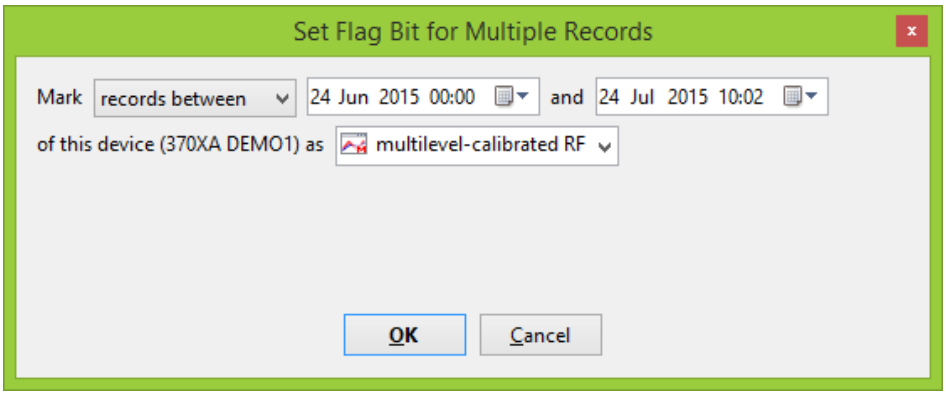
Convert To MLC instead, the numbers will change to somewhere close to zero—damaging the record permanently.

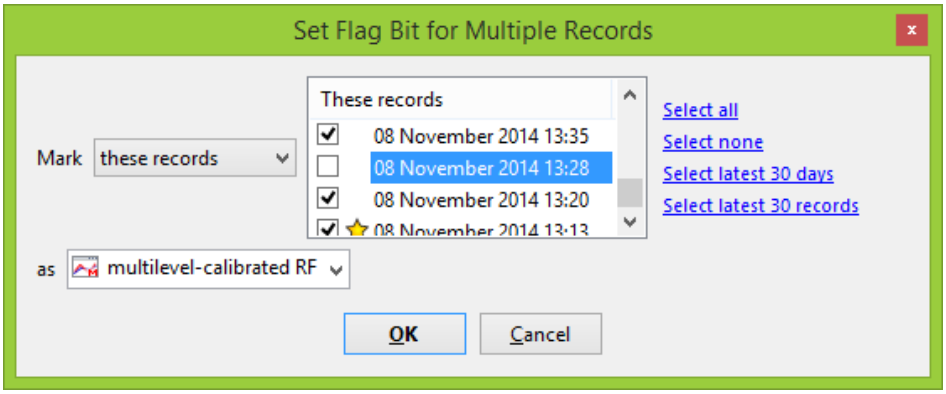
7.11.3 Change MLC Flag Bit (Multiple Records)

Changing MLC flag bit as described in chapter 7.11.2 only changes one record at a time. Sometimes you need to change flag bit of a bunch of records, such as when you notice calibration records coming from data capture should be marked as MLC but you forgot to set it in modbus mapping. Therefore all these records are still wrongly marked as single-point. To save time, go to the Action menu, select **ISO 10723**, then select **Mark As... (Bulk)**.

This dialogue lets you change MLC flag bit of all records of the selected GC device (no exceptions), or limited to certain date range, or specific selections of available records. For specific selections, a ☆ star indicates a footprint.







Note

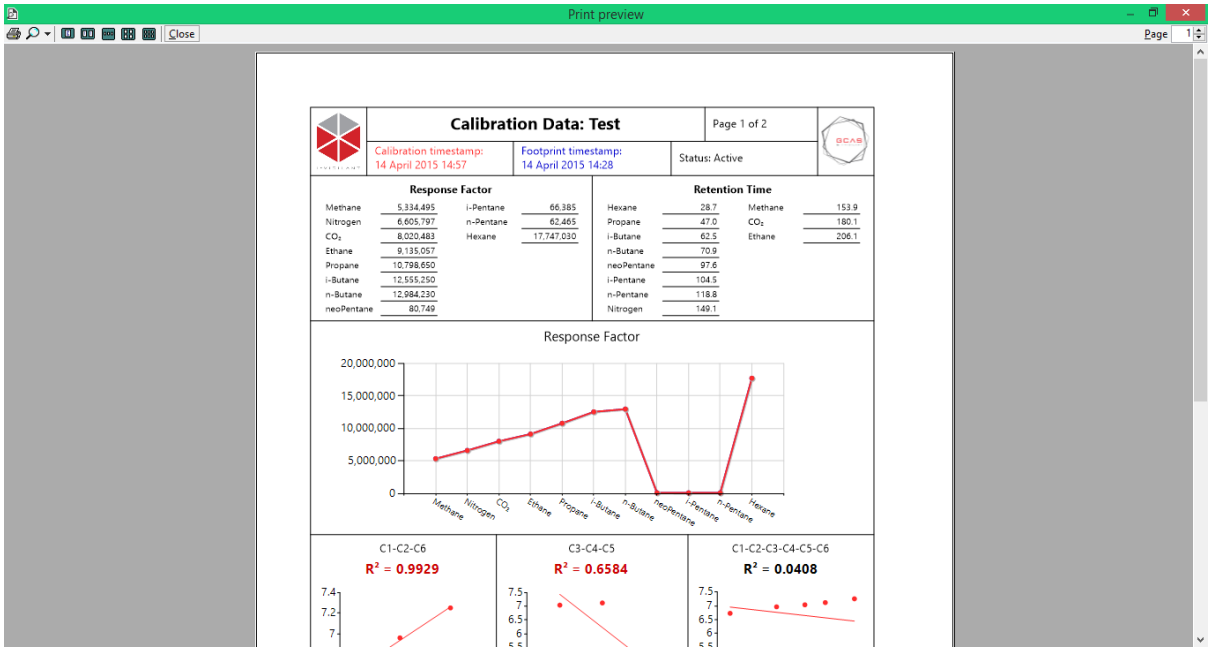
There is no *Convert To* feature for bulk operation because it may damage multiple records.

7.11.4 MLC Constraints

We moved the explanation about concepts and application of MLC constraints to chapter 22.2. Most of the time, users need not to worry about MLC constraints. However there is a slim chance the default MLC constraints causes nonsensical RF values, such as 300 billions where it should be about 17 millions. In such cases, you may need to override the MLC constraints in order to get the correct result. Read more on chapter 22.2 about MLC constraints.

7.12 Printing

From an open Footprint or Calibration Data, go to the File menu on the main menu bar. Select **Page Setup** to configure paper size and print orientation. Select **Print Preview** to get a preview or **Print** to begin printing. Alternatively, the menu Print Preview and Print are also found inside the Action menu. The **Quick Print** menu immediately sends the footprint or calibration data to your *default printer* according to what has been set in Windows Control Panel, using current page setup (default is A4 portrait).



Print preview dialogue.

GCAS Desktop has different print layout for portrait and landscape orientation. GC health status and user comments are printed on subsequent pages.

8 Mole Composition

Mole composition (formerly "mole percentage") is a record of, as its name suggests, mole composition of either calibration gas or process gas in one chromatography cycle.

Note

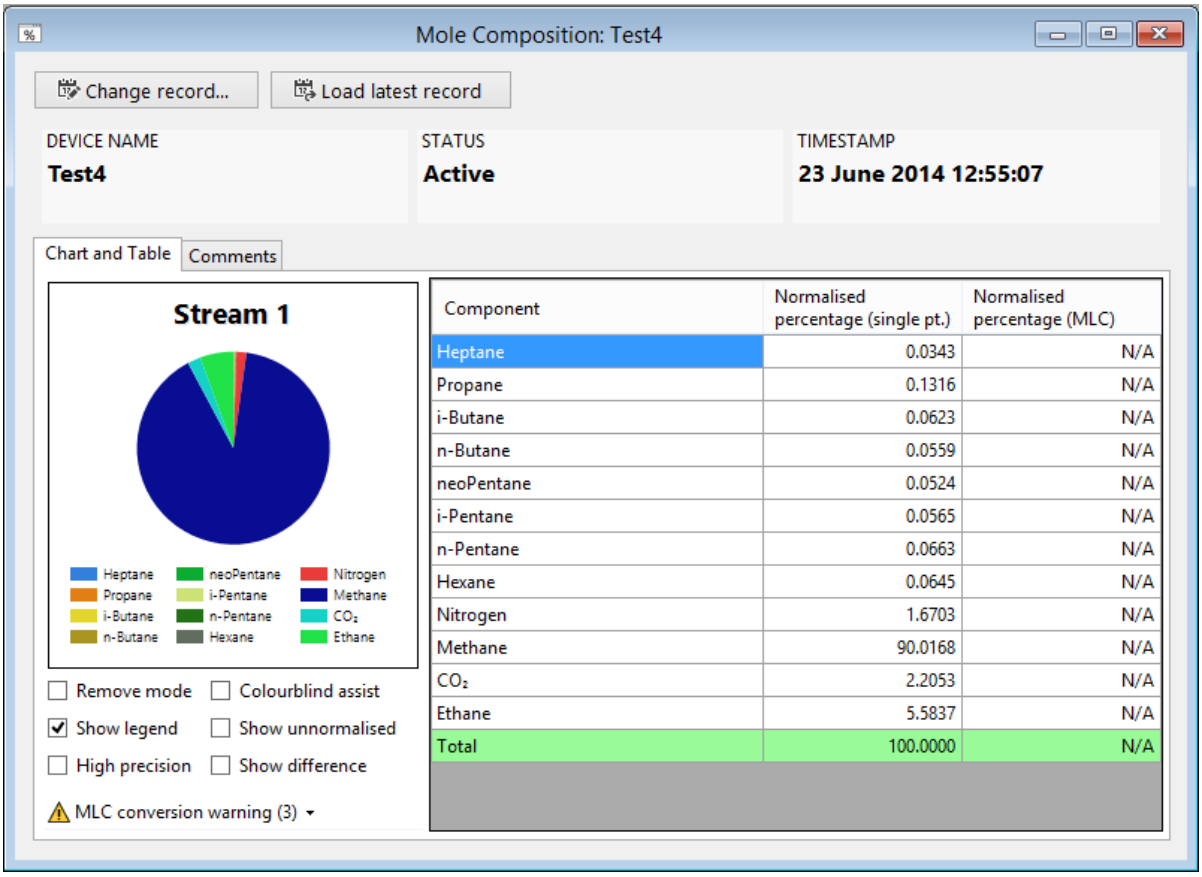
In order to use features related to mole composition e.g. Mole Composition form, mole composition data capture, and mole composition data analysis, you need GCAS feature *Live Data Analysis* in your GCAS licence.

Early versions of GCAS Desktop only recognises mole percentage, but now GCAS can work with any scale. We generalise mole percentage, fraction, or whatever scale it is, into one name – mole composition. From this chapter onward, the term "mole composition" may be abbreviated as "MC".

8.1 The *Mole Composition* Form

Mole Composition form displays mole composition data presented in grid view. By default, numbers in this grid is the *normalised* composition. The pie chart next to the grid helps visualising the data, although in many cases methane composition overwhelms everything else. This is caused by the use of *balanced methane* in calibration gas.

To open Mole Composition form, select the device from device panel on the main user interface, then go to the View menu > **Mole Composition**.



Mole Composition form as seen by users with ISO 10723 feature included in GCAS licence. Users without ISO 10723 feature will not see features related to multilevel calibration (MLC).

As mole composition data may come from multiple streams, the stream number is displayed on top of the pie chart. Some GC designates stream 1 as the calibration stream and stream 2 as process stream, while some others specify stream numbers the other way round. GCAS Desktop can also handle GC devices with more than two streams, the appropriate stream number is always there on top of the pie chart.

Remove mode check box will hide the mode (Latin: *modus*) from the pie chart. That is, the datum with highest value among other data. For example, if you have methane composition at 90%, it would be difficult to see other gases cramped in the remaining 10%. Ticking this option will hide methane from the pie chart.

Show legend toggles show or hide the legend of pie chart.

High precision causes the form to show all numbers in 8-digit decimals instead of four digits. If you see some rounding errors, that is because GCAS uses 32-bit floating point for mole composition data to save database space.

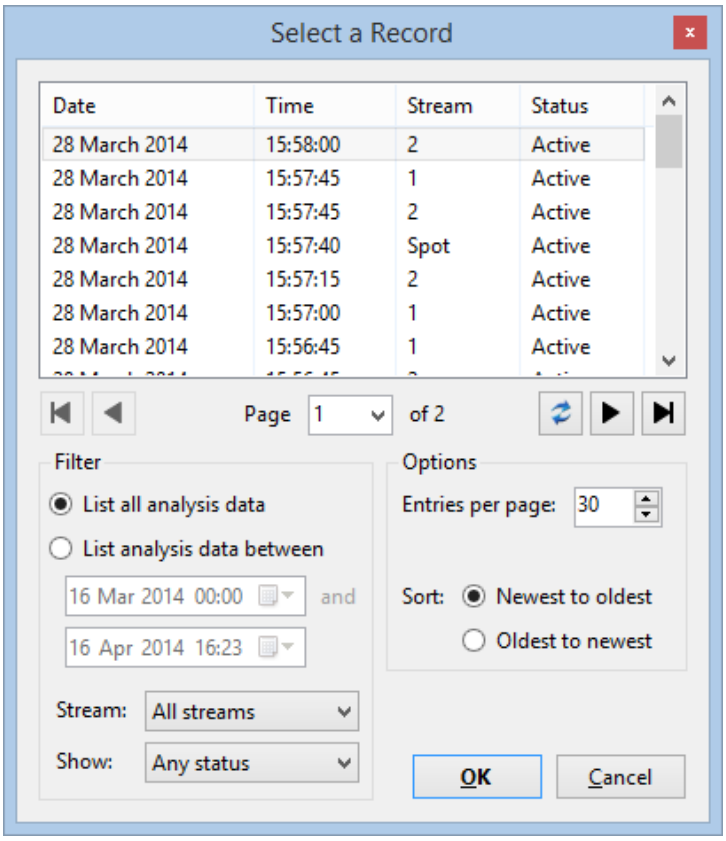
Colourblind assist. To aid users with colour blindness (protanopia and deuteranopia), GCAS Desktop provides an alternative colour scheme for the pie chart.

Show unnormalised reveals third column in grid view: the unnormalised composition. If you have *ISO 10723* feature in your licence, this check box also reveals the unnormalised MLC composition as well. Nonetheless, the pie chart always displays normalised composition.

Show difference check box is available for customers having *ISO 10723* feature in their licences. This check box reveals an additional column in grid view called the delta. It contains the difference between normalised single-point composition and normalised MLC composition. Delta is computed as single-point minus MLC.

8.2 View Previous Records

To load previous mole composition data, click **Change record** button at the top region of the form. Select a different record, then click **OK** or double click the list item.



Select Record dialogue. Timestamps on this screenshot are fictional, actual records are usually 4-7 minutes apart.

You can always load the latest mole composition data through **Load latest record** button.

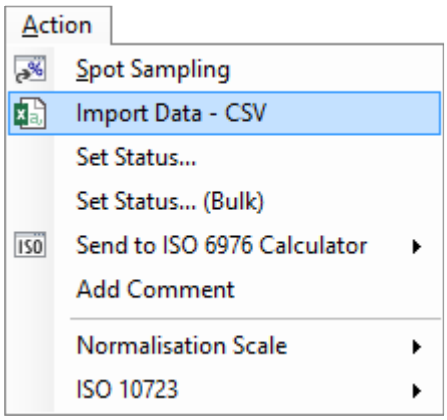
8.3 Import New Composition Data

Unlike footprint or calibration data import which allows text files, CSV files, or manual entry; GCAS Desktop supports only CSV import for mole composition data—if not captured live using data capture. The CSV file must follow the standard template for mole composition. The template file

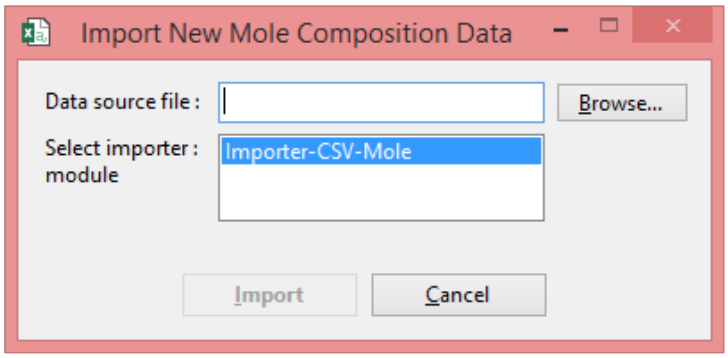
should be in your installation directory or in the browser/HTML version of GCAS Desktop Manual. Look for `CSV import file template.zip` in your installation directory. If you lose this template, you can easily recreate new one by following the guide in the information box at the bottom of this chapter.

Below are the steps to import mole composition data.

1. Select the GC device whose data to be imported on your device panel.
2. Open Mole Composition form through the View menu > Mole Composition.
3. Notice the Action menu on the menu bar.
4. Open the Action menu and select **Import Data - CSV**.



5. Load the CSV file and then click **Import**.



If you do not see this menu, your user account may not have the action permission for it or the CSV import feature is not included in your GCAS licence. Contact your GCAS administrator.

GCAS Desktop treats all numbers in the CSV file as *unnormalised* composition and will normalise them before they are committed to GCAS database.

Lost your template?

GCAS Desktop has two CSV templates, one is for footprint and calibration data import while the other is for mole composition import. For mole composition import, the column assignments are:

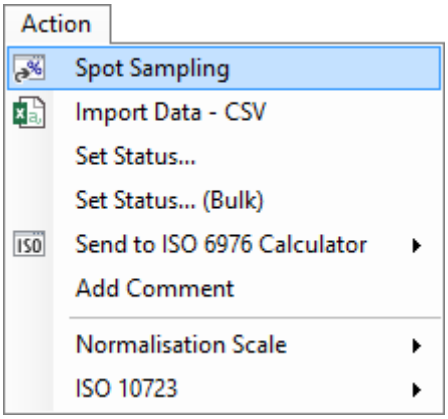
Column	Excel name	Description
1	A	Device tag name. (Yes, you can import data for multiple devices in one go.)
2	B	Stream number.
3	C	Record timestamp in the format of **dd/mm/yyyy hh:mm** (24-hour clock).
4	D	Methane mole composition.
5	E	Nitrogen MC.
6	F	Carbon dioxide MC.
7	G	Ethane MC.
8	H	Propane MC.
9	I	i-Butane MC.
10	J	n-Butane MC.
11	K	Neopentane MC. If your device doesn't read neopentane, fill in **0** (zero).
12	L	i-Pentane MC.
13	M	n-Pentane MC.
14	N	Hexane MC.
15	O	Heptane MC. If your device doesn't read heptane, fill in **0** (zero).
16	P	Octane MC. If your device doesn't read octane, fill in **0** (zero).
17	Q	Nonane MC. If your device doesn't read nonane, fill in **0** (zero).
18	R	Decane MC. If your device doesn't read decane, fill in **0** (zero).
19	S	Unnormalised total.
20	T	Is it multilevel-calibrated MC? Fill **0** for single-point, or **1** for MLC. If you don't have *ISO 10723* in your licence, **always fill 0** (zero).

8.4 Spot Sampling

A *spot sample* is a special mole composition record. Regular mole composition record is the composition of gases read by the GC device, but spot sample is the composition of gases *before* they enter GC device. Spot sampling is conducted directly on the pipeline (on the *sample probe*) before entering the pressure letdown system (hence the name "spot"); or if the process gas is delivered in gas tank/canister then the sampling method is administered straight on the canister.

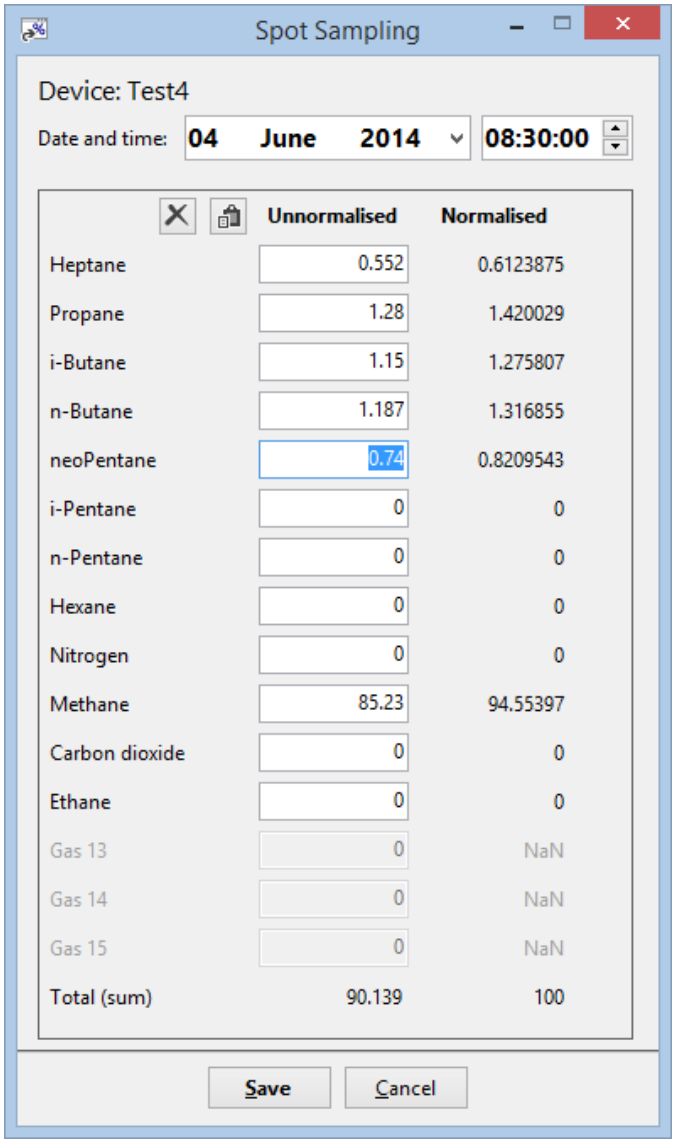
The purpose of spot sampling is to verify if your pressure letdown system works properly — no leakage, no condensation, no dropout, etc. If the spot sample record is very close to the regular mole composition record (taking the lag time into account), then generally speaking your pressure letdown system should be fine.

To enter spot sample data, select the device from the device panel then open the Mole Composition form through View menu > Mole Composition. Open the Action menu, then click **Spot Sampling**.



This brings forth the *Spot Sampling* form. **First thing first, enter the date and time of when the sample was taken**. Once the record commits to database, you cannot change its timestamp but you can set it as inactive and re-enter a same record with the correct timestamp.

The next step is to key in mole composition value of each gas. The composition you are entering now is the *unnormalised* composition.

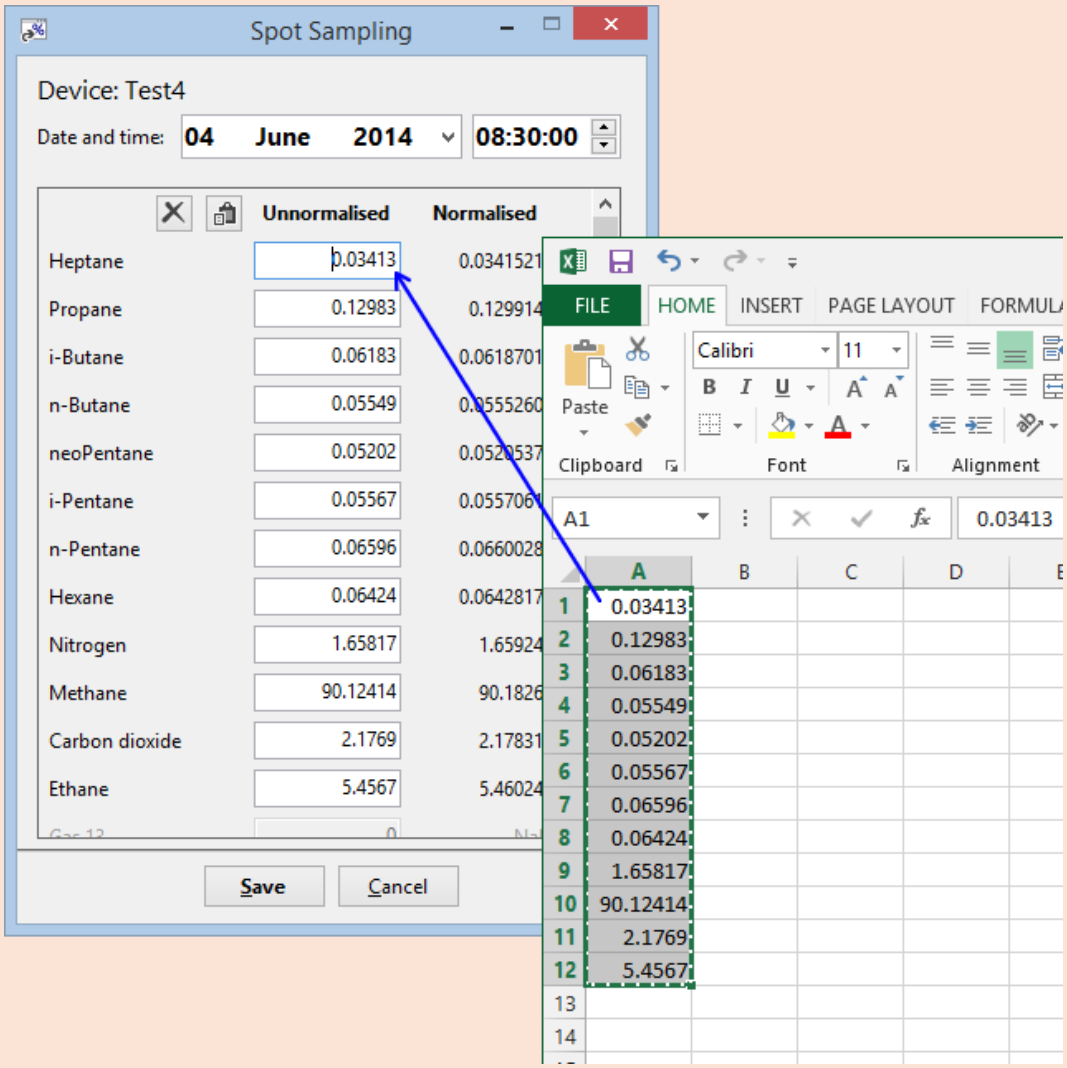


As you type, the total/sum is updated accordingly and all values are automatically normalised in the rightmost column. The form deduces the correct scale automatically. Therefore, for a few first gases, total/sum for normalised column may display 1 (mole fraction) or 10 (decimal). As you fill in more and more fields, the scale will change accordingly and typically end up in 100 (percentage).

Always double-check the numbers to avoid potential human error. When you are ready, click **Save** to commit the record.

Tip

You can copy values from Microsoft Excel or other spreadsheet processing software. Press `Ctrl+V` inside the **first text box** and the rest will follow. Alternatively, click **Paste** button.

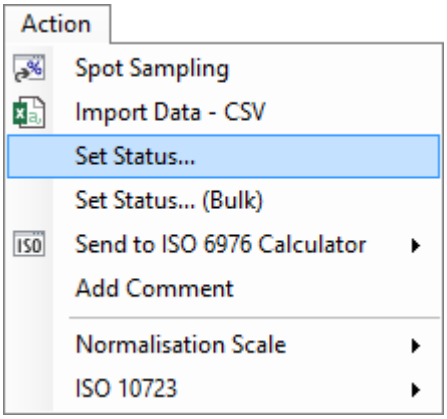


Click **Clear** to reset all fields back to zero.

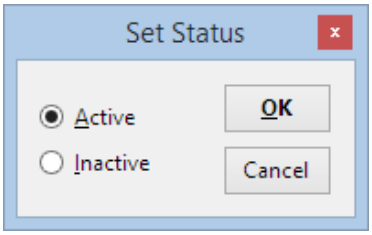
8.5 Change Record Status (Single Record)

Similar to footprint and calibration data record, every mole composition record has a status bit indicating either active or inactive. Similarly, inactive records will not appear in data analysis and will not affect the calculation of mean and standard deviation, uncertainty calculation, ISO 6976 trend, and many others. To change record status of the mole composition record currently loaded, do the following:

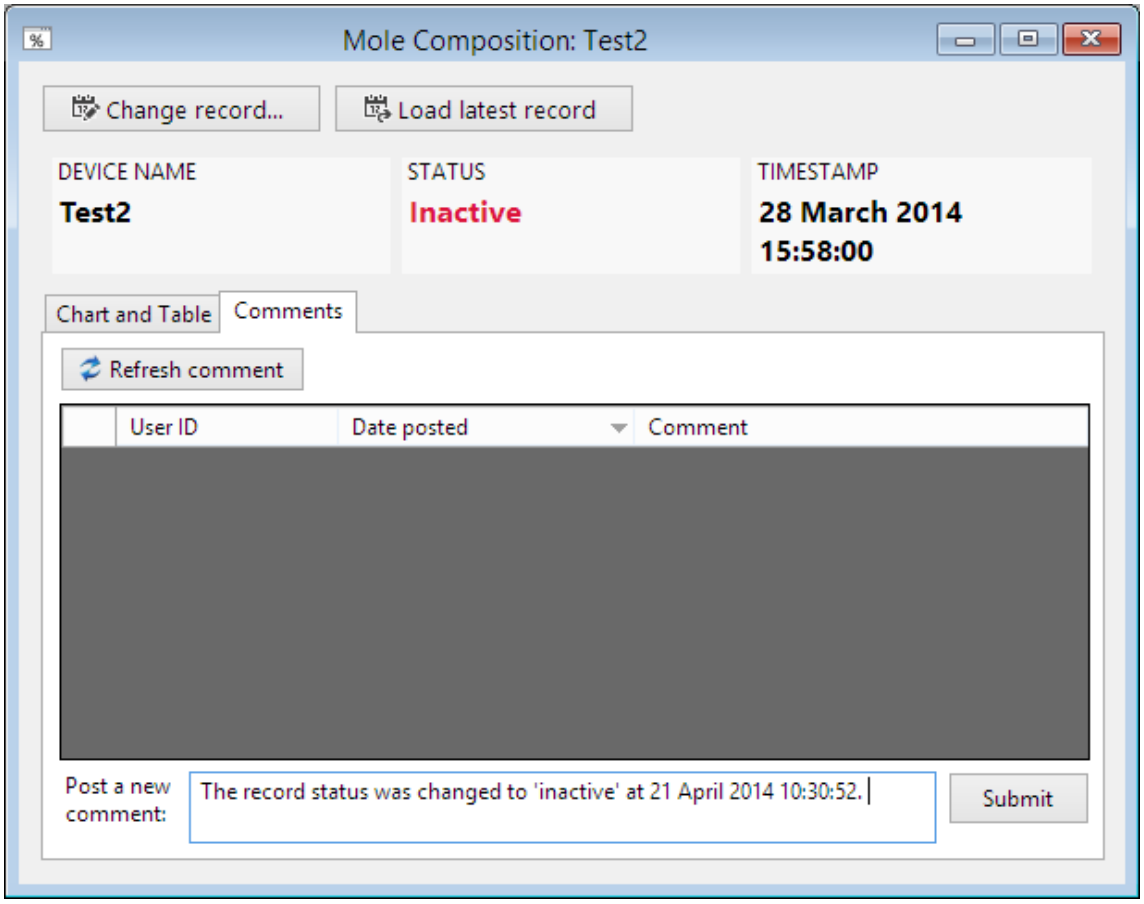
1. From an open Mole Composition form, go to Action menu > **Set Status**. If you do not see this menu, your user account may not have the action permission for it. Contact your GCAS administrator.



2. This will show *Set Status* dialogue. Choose the appropriate record status then click **OK**.



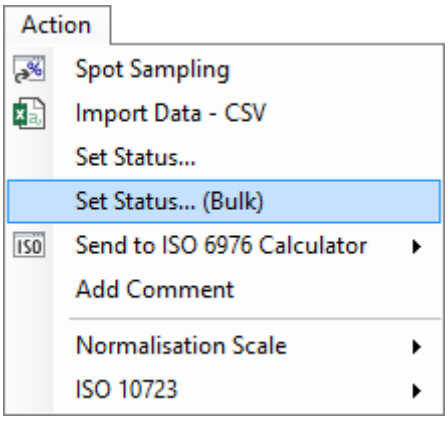
3. The form will reload the record and you should see the new status at the upper section. Afterwards, the **Comments** tab opens automatically and it is recommended to write a comment of why the record status was changed. Comments tab does not open in case your GCAS user account doesn't have the action permission to post comments.



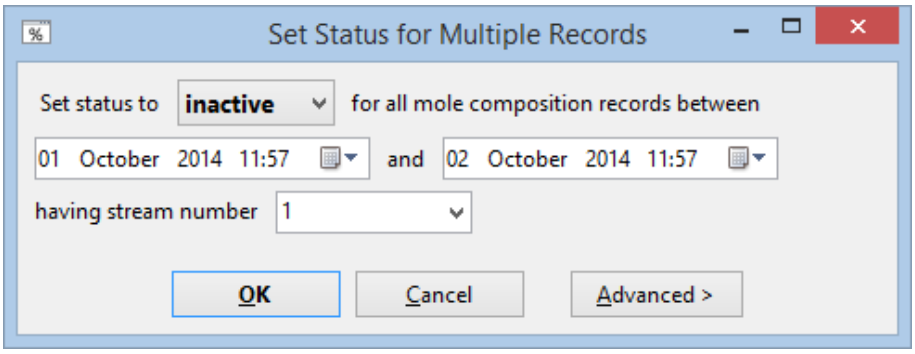
8.6 Change Record Status (Multiple Records)

Mole composition records mostly came from a data capture operation. To make it worse, many users set the data capture in unattended mode. If an error happened during unattended data capture, bad records will still be committed into database. This may lead to numerous unusable records in the database and it is a tedious work to set their status as inactive one by one. GCAS Desktop includes a tool to set record status in bulk (batch) operation.

From an open Mole Composition form, open the Action menu and select **Set Status (Bulk)**. If you do not see this menu, your user account may not have the action permission for it. Contact your GCAS administrator.



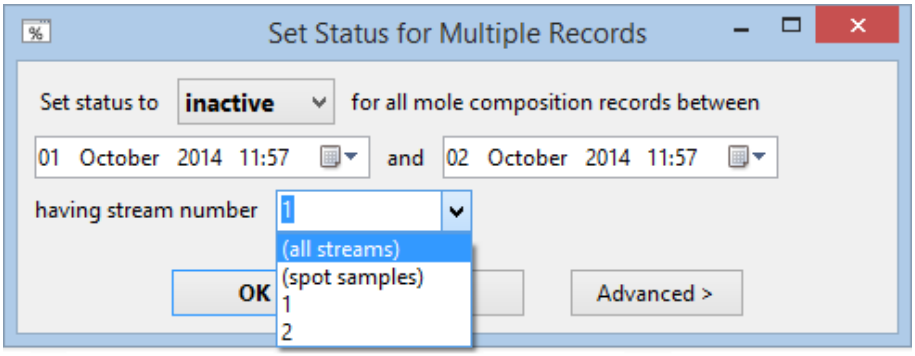
This menu brings the *Set Status for Multiple Records* dialogue. This window has two views, namely *simple view* and *advanced view*. The first time this dialogue opens, it is on simple view.



8.6.1 Simple View

Using simple view, you set the desired record status (active or inactive) for all mole composition records between the two date/time perimeters. This may or may not be filtered to a stream number.

The user interface in simple view is pretty straightforward. Depending on how many stream numbers ever recorded into the database, stream number selection may look like this.



If you choose **(all streams)**, that will change record status of all mole composition records within the defined date boundaries regardless of stream numbers *except spot samples*. If you choose **(spot samples)**, the status change only applies to spot sample records within the date interval. All next choices afterwards are the actual stream numbers available. You can also type the desired stream number if it is not on this list. To confirm, click **OK** and GCAS Desktop begins the batch operation.

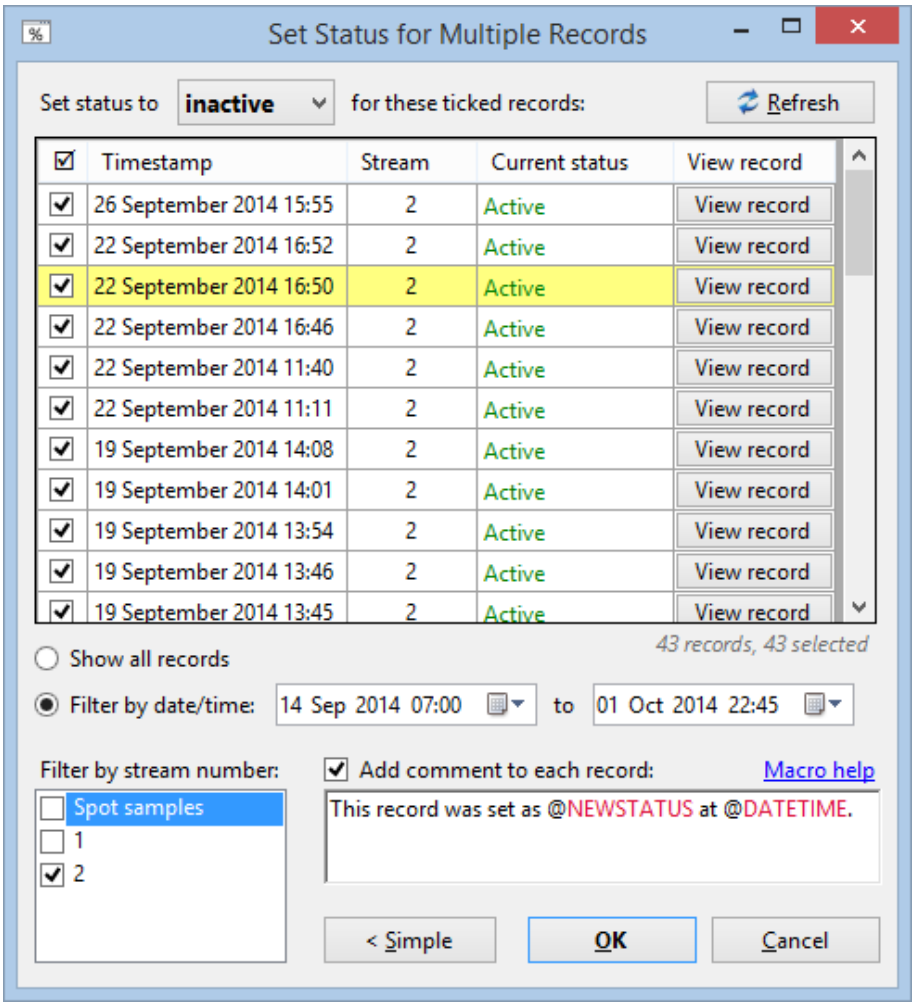
Note

GCAS Desktop does not add automatic comment such as "`This record status was changed to inactive at <current computer time>`" for bulk status change in simple view. Use advanced view if you want to attach comments to these records.

To switch into advanced view, click **Advanced** button.

8.6.2 Advanced View

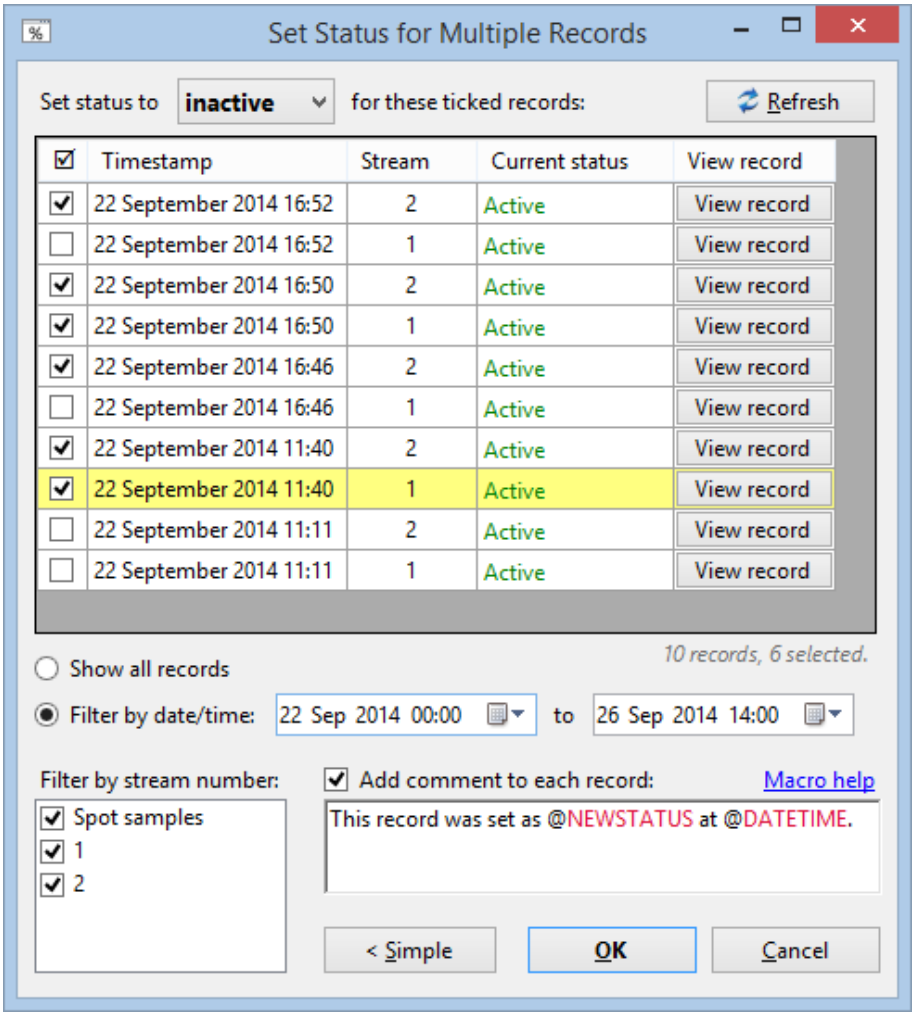
Advanced view gives more flexibility to set record status for multiple records. In advanced view, GCAS Desktop gives a list of mole composition records and you tick which ones to change status.


Set Status for Multiple Records
Set status to inactive for these ticked records:
Refresh
Timestamp
Stream
Current status
View record
26 September 2014 15:55 2 Active View record
22 September 2014 16:52 2 Active View record
22 September 2014 16:50 2 Active View record
22 September 2014 16:46 2 Active View record
22 September 2014 11:40 2 Active View record
22 September 2014 11:11 2 Active View record
19 September 2014 14:08 2 Active View record
19 September 2014 14:01 2 Active View record
19 September 2014 13:54 2 Active View record
19 September 2014 13:46 2 Active View record
19 September 2014 13:45 2 Active View record
43 records, 43 selected
Show all records
Filter by date/time: 14 Sep 2014 07:00 to 01 Oct 2014 22:45
Filter by stream number:
Spot samples
1
2
Add comment to each record:
Macro help
This record was set as @NEWSTATUS at @DATETIME.
< Simple
OK
Cancel

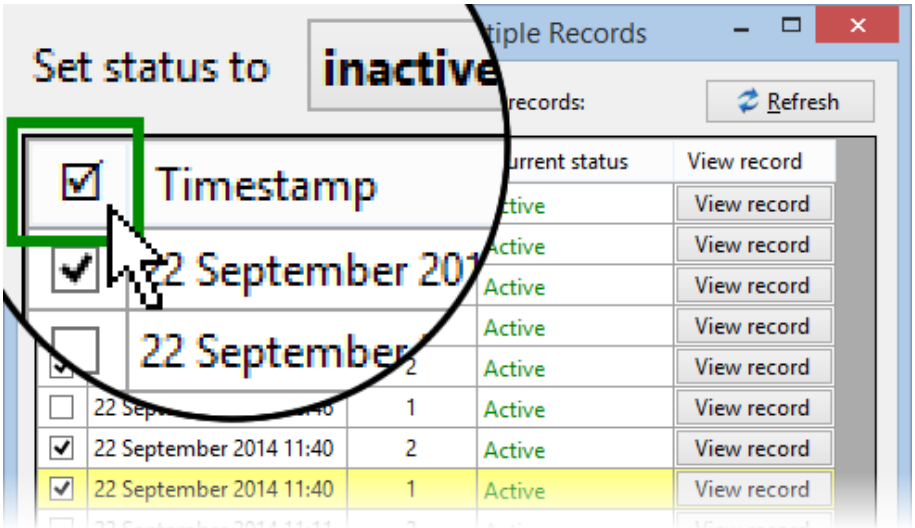
For the first time, GCAS Desktop lists all records within the last 24 hours. To change the date filter, choose **Filter by date/time** and enter the desired interval. If you choose **Show all records**, this turns off the date filter and you see all records ever exist for this GC device since the beginning. Click **Refresh** at the top right corner to apply the new date filter and reload the list.

At the bottom left corner, there is a selection of available stream numbers. Change which stream number to display on the record list, then click **Refresh** to apply the stream number filter and reload the list.

Tick or untick records you want to have their status to change. The **Current status** column displays current record status before the operation begins. To view the record content, click **View record** button available at each row. That button opens a new Mole Composition form and loads that particular record. In the example screenshot below, there are 6 records to be set as **inactive** when you press OK button. The rest (those without check mark) are left untouched, thus their status remains active.


Set Status for Multiple Records
Set status to inactive for these ticked records:
Refresh
Timestamp
Stream
Current status
View record
22 September 2014 16:52 2 Active View record
22 September 2014 16:52 1 Active View record
22 September 2014 16:50 2 Active View record
22 September 2014 16:50 1 Active View record
22 September 2014 16:46 2 Active View record
22 September 2014 16:46 1 Active View record
22 September 2014 11:40 2 Active View record
22 September 2014 11:40 1 Active View record
22 September 2014 11:11 2 Active View record
22 September 2014 11:11 1 Active View record
10 records, 6 selected.
Show all records
Filter by date/time: 22 Sep 2014 00:00 to 26 Sep 2014 14:00
Filter by stream number:
Spot samples
1
2
Add comment to each record:
Macro help
This record was set as @NEWSTATUS at @DATETIME.
< Simple
OK
Cancel

Click on the column header of the check boxes (yes, that one with a boxed check mark symbol) to quickly check all or uncheck all records in the list.



Click the column header to quickly tick all or untick all records.

You can also attach a comment to each record like what GCAS does in single record status change. To do so, give a check mark at **Add comment to each record**. Then write your comment at the text box under the check box. The same comment is applied to every ticked record when their statuses are being changed.

The comment box recognises five keywords called *macro*(s) which it automatically highlights in red. Macro identifier starts with the '@' symbol and is all-uppercase. GCAS Desktop replaces these macros with actual values before writing them into database.

Macro keyword	Will be replaced with
@OLDSTATUS	Previous record status ("`active`" or "`inactive`")
@NEWSTATUS	New record status ("`active`" or "`inactive`")
@DATE	Current computer date, e.g. "`15 September 2014`".
@TIME	Current computer time in 24-hour format, e.g. "`16:28:44`".
@DATETIME	Current computer date and time, e.g. "`15 September 2014 16:28:44`".

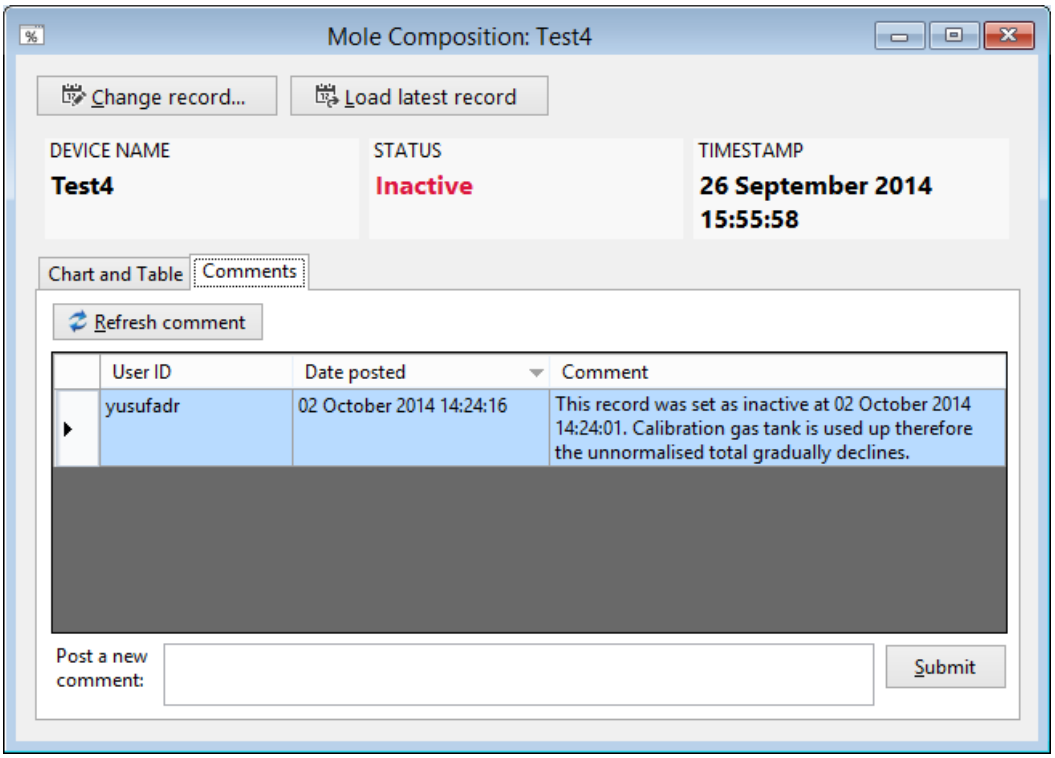
For instance, this comment macro:

```
This record was set as @NEWSTATUS at @DATETIME. Calibration gas tank is
used up therefore the unnormalised total gradually declines.
```

will be replaced with actual values such as:

```
This record was set as inactive at 02 October 2014 14:24:01. Calibration
gas tank is used up therefore the unnormalised total gradually declines.
```

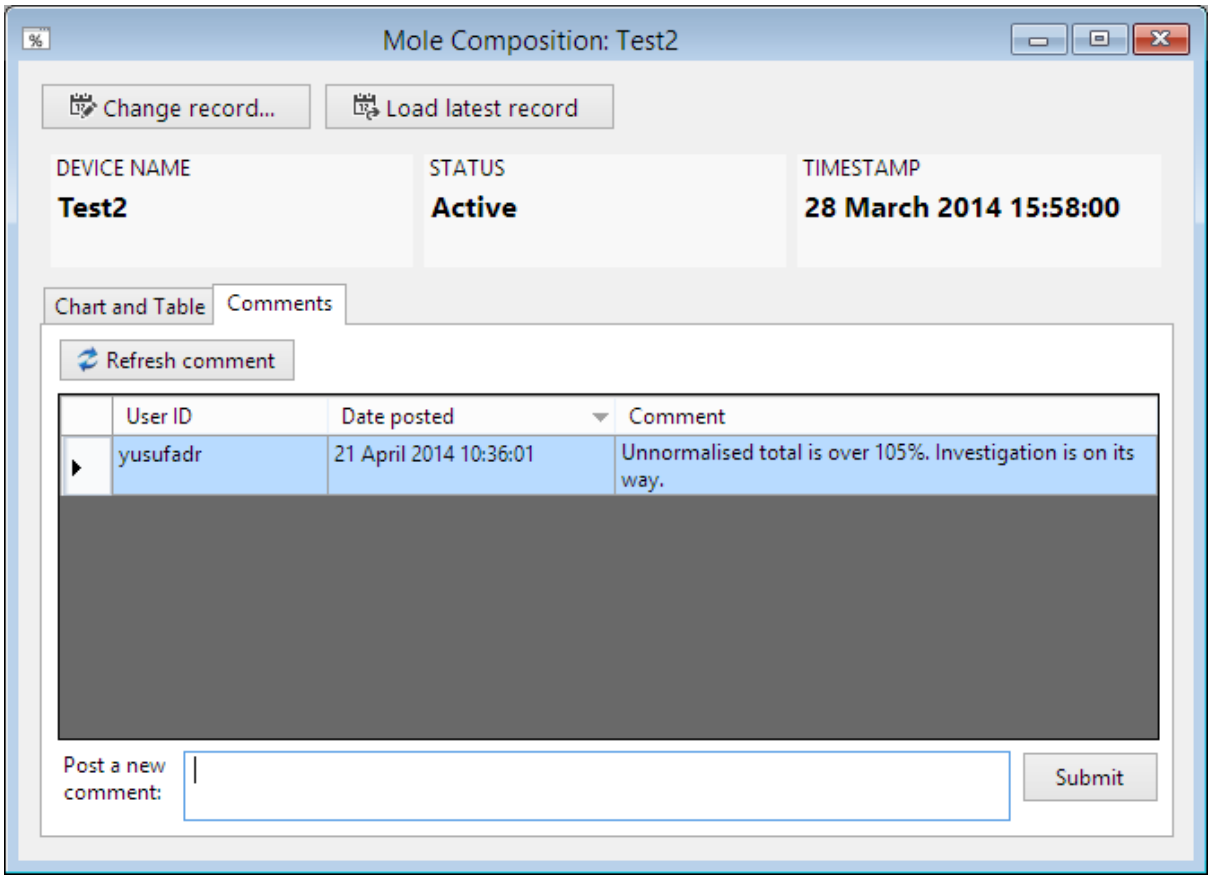
Which you can easily verify by visiting any record included in bulk operation, like this one.



To switch back into simple view, click **Simple** button at the left side of **OK** button.

8.7 Insert Comment

Like footprint and calibration records, users can also put comments on a mole composition record.



1. To insert comment, open the **Comments** tab or go to Action menu > **Add Comment**.
2. Write your comment on the text box at the lower section of the form, then click **Submit**.
3. Make sure the comment is correct (e.g. free from spelling errors) because once inserted into database, you will not be able to remove the comment.

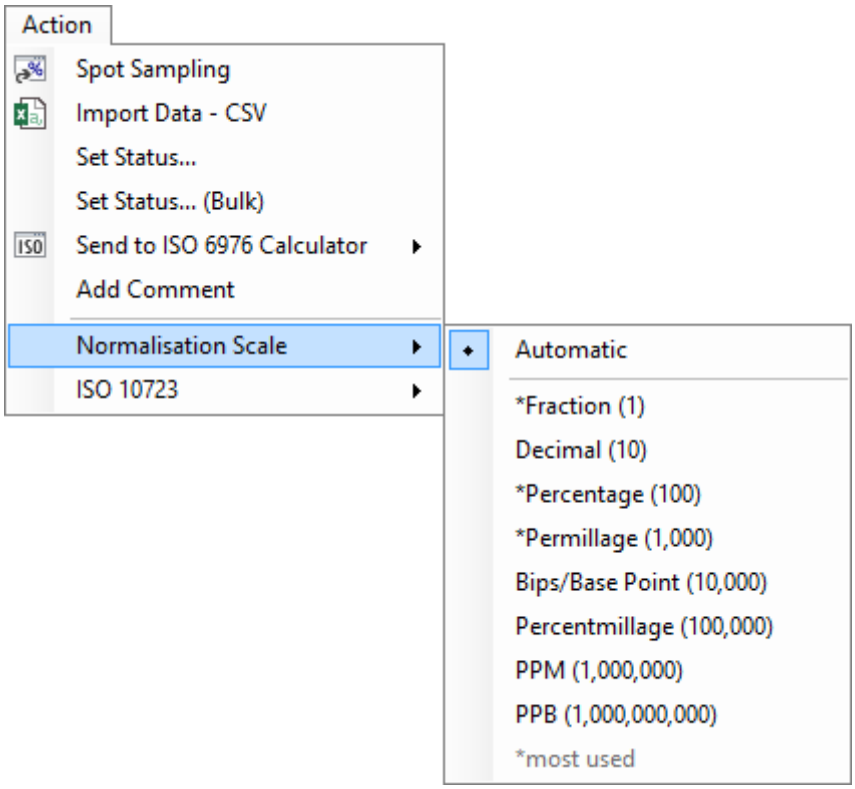
If you do not see the textbox and the Submit button, i.e. the comment grid fills up the entire form, your user account may not have action permission to write comments or your user role is *Read-only*. Contact your GCAS administrator.

8.8 Automatic or Fixed Scale

Early versions of GCAS works only with percentage scale, but now it works with any scale up to parts per billion (PPB). GCAS automatically determines which scale to use according to the unnormalised total value. If the unnormalised total is around 100, then it is percentage. If it is around 1000, probably it is permillage (‰).

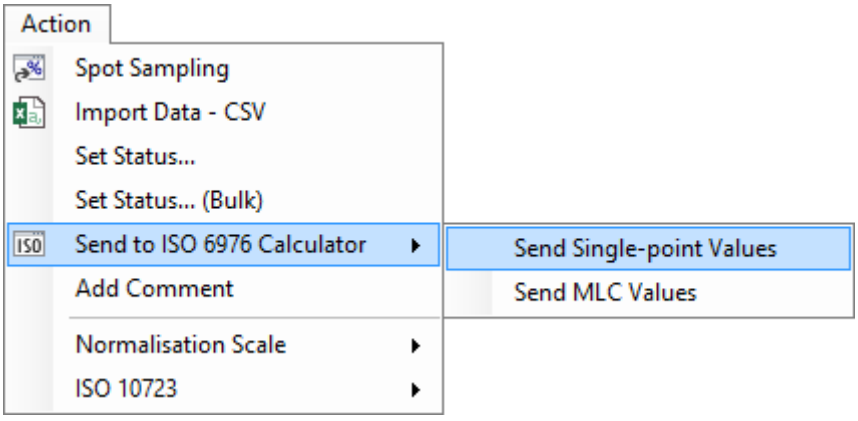
The automatic scale may not work as you expect. For example, a problem on the GC or the pipeline caused the unnormalised total to drop to 15%. This number is close to 10, therefore GCAS assumes the scale is decimal (0 to 10). You know the GC reads the composition in percentage scale, hence the decimal scale may hinder troubleshooting.

To override this automatic scaling, browse to the desired mole composition record then open the Action menu. Under **Normalisation Scale**, select which scale to use. Mole Composition form is now locked to the selected scale until it is closed.

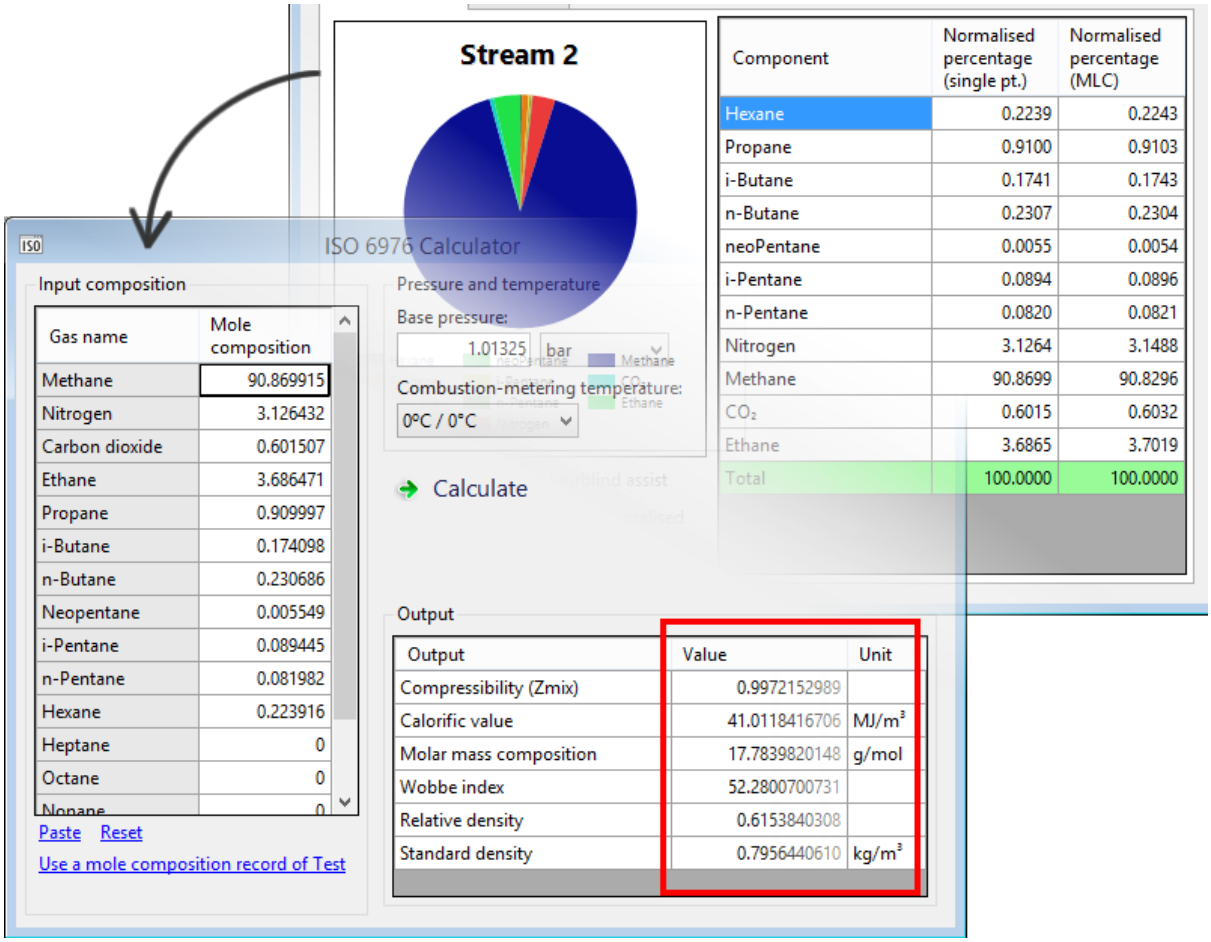


8.9 Send to ISO 6976 Calculator

Users whose GCAS licence includes GCAS feature *ISO 6976 Calculator* shall see an additional action menu called **Send to ISO 6976 Calculator**. This shortcut sends the mole composition record to ISO 6976 Calculator tool. It calculates the calorific value (CV) and other properties of this composition.



Users with *ISO 10723* feature included in their licences shall see two submenus. One will send normalised single-point composition, while the other will send normalised multilevel-calibrated composition. Users without *ISO 10723* see no submenus, the menu itself will send normalised single-point composition. For more information about ISO 6976 Calculator, visit chapter 19.



8.10 Multilevel-Calibrated MC (ISO 10723)

GCAS Desktop supports the traditional single-point mole compositions as well as multilevel-calibrated (MLC) mole compositions.

Note

This feature requires *ISO 10723* feature in your GCAS licence.

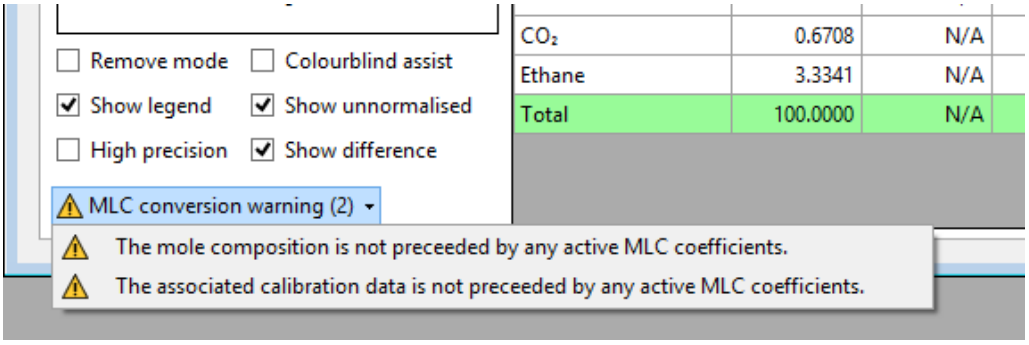
Users with *ISO 10723* feature on their licences will see two columns when Mole Composition forms is loaded for the first time. First is normalised single-point composition, second is normalised MLC composition. Unlike multilevel-calibrated RF, multilevel-calibrated mole composition (MC) have values close to its single-point counterpart. The difference between single-point and MLC mole composition is usually called **bias**.

ISO 10723 conversion for mole composition requires:

1. A multilevel calibration (MLC) coefficient set installed before the timestamp of the mole composition record, and
2. An active, *MLC-convertible* calibration data or footprint before the timestamp of the mole composition record; which in turn requires:
3. A multilevel calibration (MLC) coefficient set installed before the timestamp of this footprint/calibration record, and finally
4. An active calibration gas certificate installed before the timestamp of this footprint/calibration record.

If one or more of these conditions are not met, the mole composition record is said to be *not convertible*. GCAS Desktop displays a ⚠ warning icon at the bottom of the form, below the pie chart, if:

1. One or more of the four conditions above are not fulfilled, or
2. The MLC coefficient set used by the mole composition record and coefficient set used by the preceding footprint/calibration data are different. This can happen if there is a new coefficient set installed between the timestamp of the calibration data and the timestamp of mole composition record.


Remove mode
Colourblind assist
Show legend
Show unnormalised
High precision
Show difference
MLC conversion warning (2)
The mole composition is not preceeded by any active MLC coefficients.
The associated calibration data is not preceeded by any active MLC coefficients.
CO₂ 0.6708 N/A
Ethane 3.3341 N/A
Total 100.0000 N/A

Click on the warning icon to see the detailed reason why the record is not convertible. Some items on the warning dropdown are shortcuts. For example if it says the record is not preceeded by any MLC coefficient sets, clicking on that item brings you the MLC Coefficients form in edit mode so you can enter the coefficients straight away.

Non-convertible records display "N/A" in either single-point or MLC columns in both normalised and unnormalised, depending on its MLC flag bit. Records having flag bit marked as single-point which is not convertible into MLC will show "N/A" in MLC columns and vice versa. Additionally, the delta column (through *Show difference* check box) will be empty.

Note

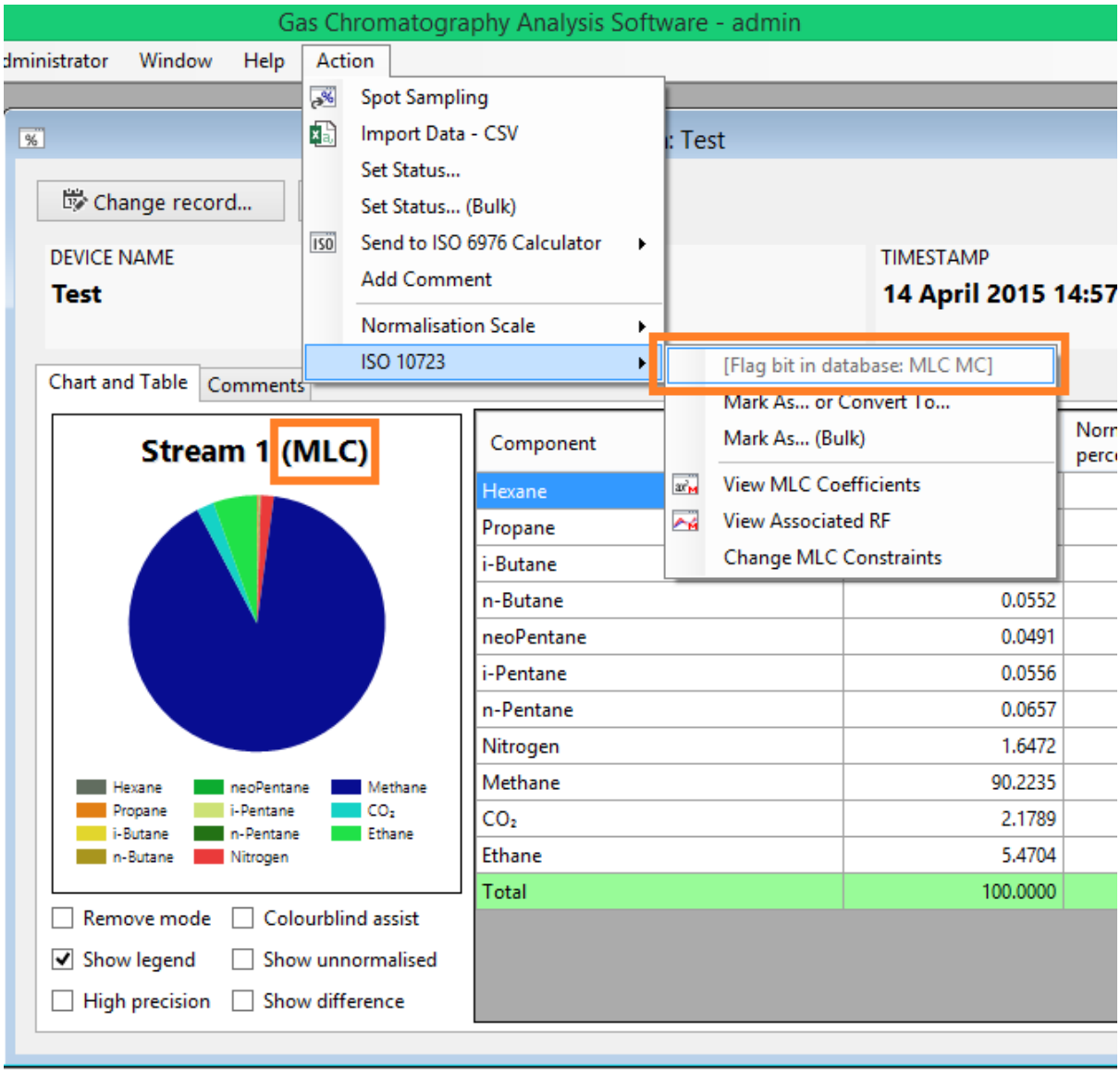
Spot samples are never convertible. Spot samples are always marked as single-point compositions.

To see the MLC coefficients associated with current record, open the Action menu, select **ISO 10723**, then click **View MLC Coefficients**. This menu calls Multilevel Calibration Coefficients form and loads the correct coefficient set associated with current mole composition record. To see the calibration

data or footprint which is used by current mole composition record, click **View Associated RF** in the same ISO 10723 menu.

8.10.1 MLC Flag Bit

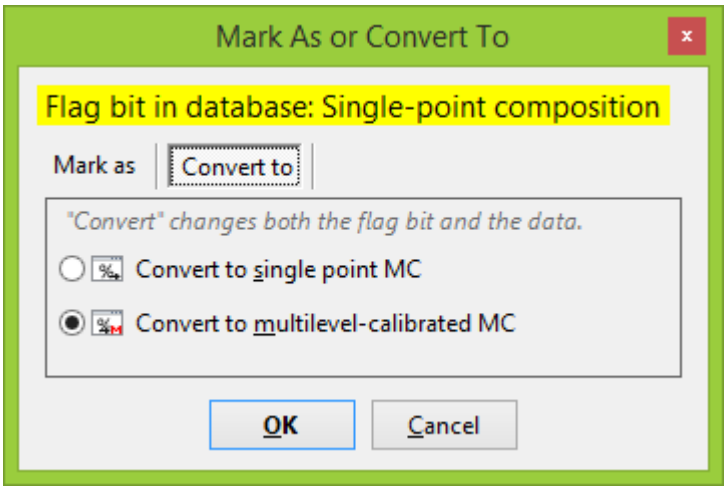
Similar to footprint and calibration data, all mole composition records have MLC flag bit to indicate whether it is single-point or multilevel-calibrated. The easiest way to see MLC flag bit is to look at the title of pie chart. It says the stream number, for example "`Stream 2`", and if the MLC flag bit is multilevel-calibrated then the title appends "`(MLC)`" after stream number. If there is no other text, then it is single-point. Alternatively, open the Action menu and select **ISO 10723**. The first submenu is not clickable but it states the MLC flag bit.



You can change MLC flag bit if necessary, however do this with caution. Because single-point compositions and MLC compositions are similar in values unlike single-point RF versus MLC RF which are completely different, it is easy to mistake which composition is single-point or MLC.

8.10.2 Mark As versus Convert To

Open Action menu, select **ISO 10723**, then select **Mark As… or Convert To…** and GCAS Desktop shows this dialogue box.



Current flag bit is highlighted in yellow to clarify what the bit value is. Next, decide whether you need to *mark* the flag bit or *convert* the whole record.

Mark As changes the flag bit only. The original numbers of all mole values are untouched. By contrast, **Convert To** changes the flag bit *and* converts all mole values, thus changing the actual numbers stored in database. Permanently.

Unlike *Mark As*, the *Convert To* operation requires action permission "MLC permanent conversion". If your GCAS administrator doesn't give you this permission, GCAS Desktop displays a message saying that you don't have sufficient permission to perform conversion when you select *Convert To* in this dialogue box.

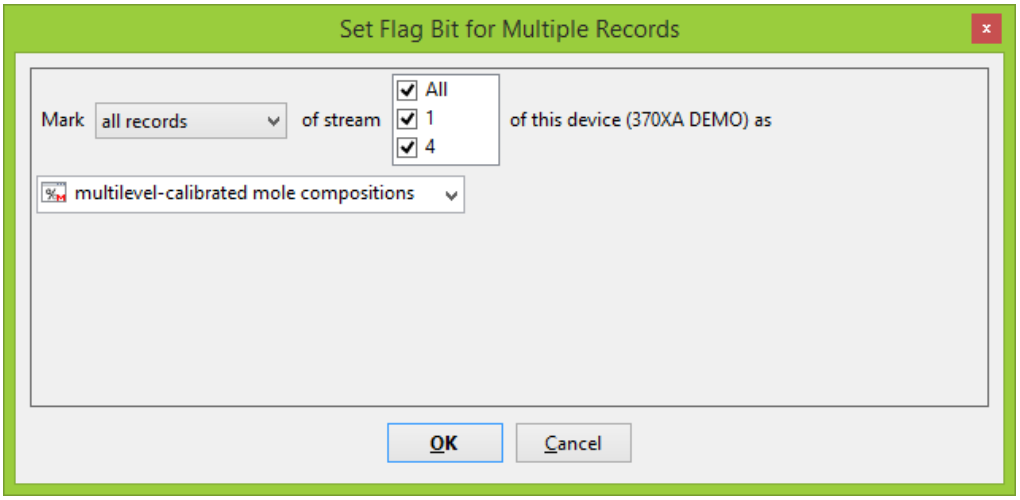
Important

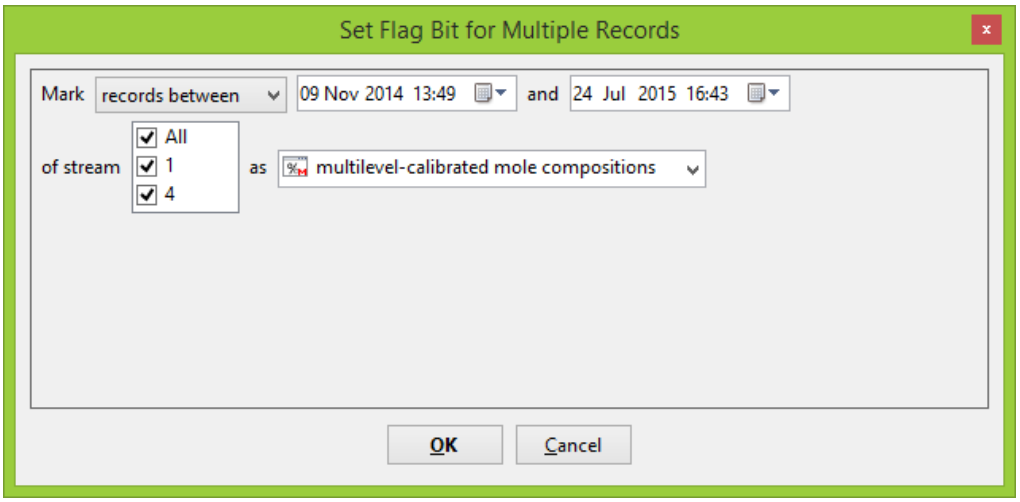
Be extra cautious when using *Convert To*. Performing permanent conversions on wrong record will damage the record permanently. Furthermore because single-point compositions and MLC compositions are similar in terms of numeric values, always double or triple check before using *Convert To*.

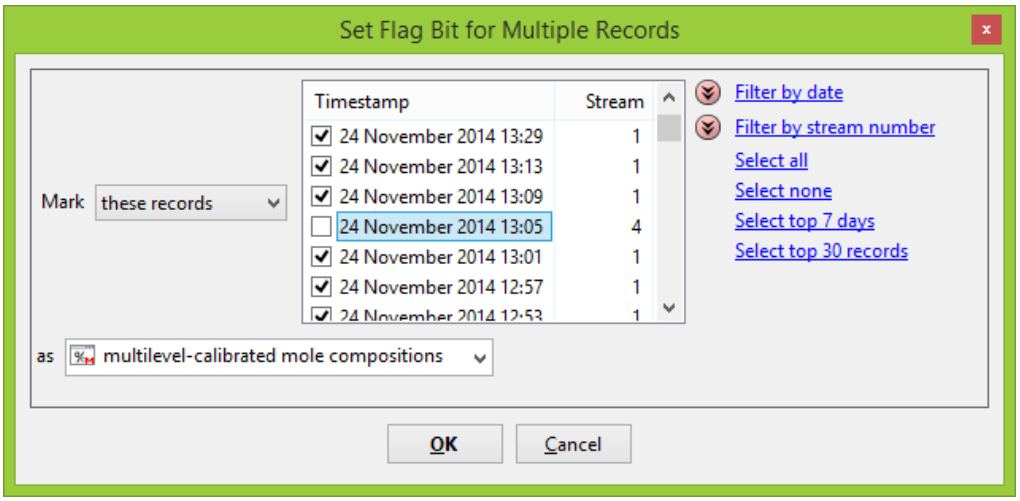
8.10.3 Change MLC Flag Bit (Multiple Records)

Chapter 8.10.2 explained how to change flag bit for one record. Mole composition records usually come from data capture operation, thus you may need to change flag bit of tens or even hundreds of records. To save your time, open the Action menu, select **ISO 10723** and then click **Mark As… (Bulk)**.

The dialogue box is slightly different from *Set Flag Bit for Multiple Records* dialogue belonged to footprint and calibration data. The *Set Flag Bit for Multiple Records* dialogue for mole compositions lets you filter by stream number, and later (optionally) by date or specific selections of records.





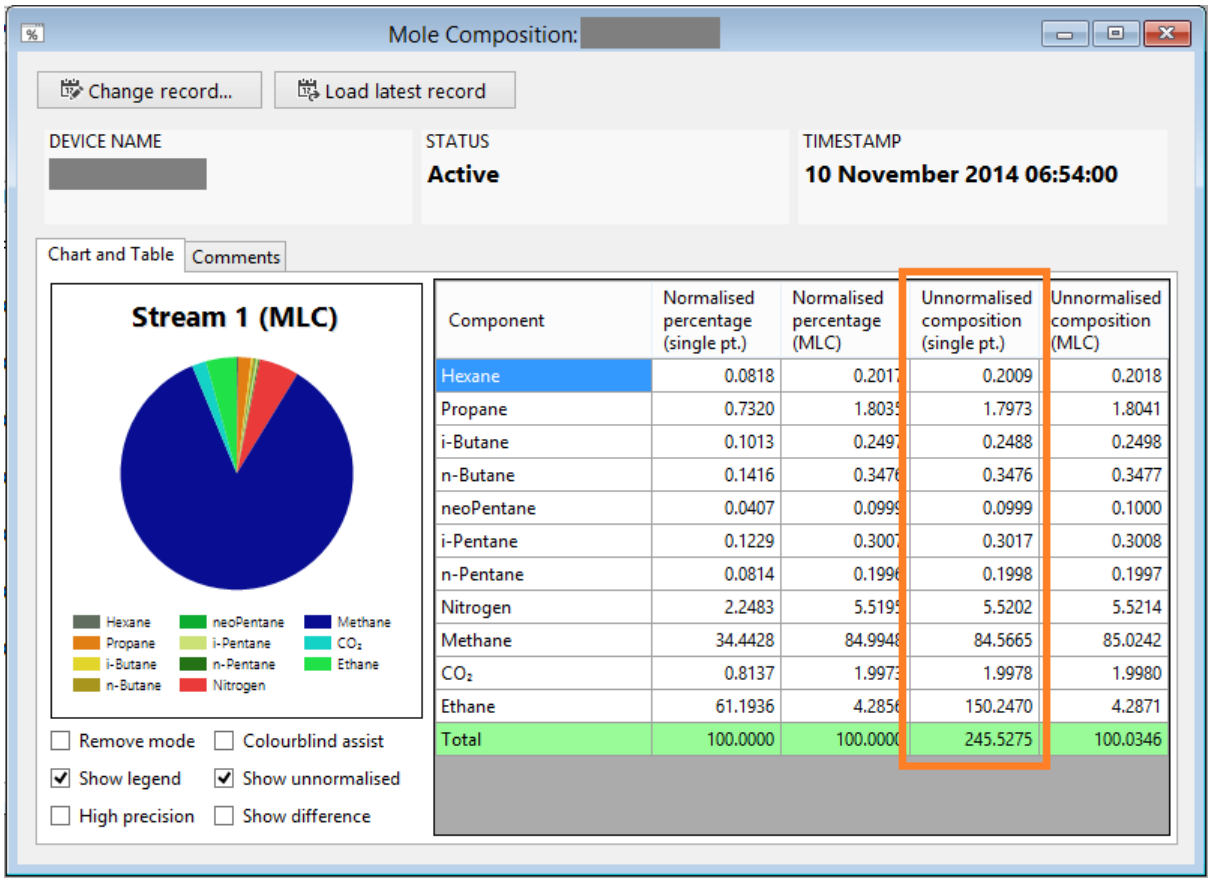


Note

There is no *Convert To* feature for bulk operation because it may damage multiple records.

8.10.4 MLC Constraints

We moved the explanation about concepts and application of MLC constraints to chapter 22.2. Most of the time, users need not to worry about MLC constraints. However there is a slim chance the default MLC constraints generates silly unnormalised total such as in the screenshot below. The ethane exceeds 150% which is nonsense. In those rare cases, you may need to override the MLC constraints in order to get the correct result. Read more on chapter 22.2 about MLC constraints.



Component	Normalised percentage (single pt.)	Normalised percentage (MLC)	Unnormalised composition (single pt.)	Unnormalised composition (MLC)
Hexane	0.0818	0.2017	0.2009	0.2018
Propane	0.7320	1.8035	1.7973	1.8041
i-Butane	0.1013	0.2497	0.2488	0.2498
n-Butane	0.1416	0.3476	0.3476	0.3477
neoPentane	0.0407	0.0999	0.0999	0.1000
i-Pentane	0.1229	0.3007	0.3017	0.3008
n-Pentane	0.0814	0.1996	0.1998	0.1997
Nitrogen	2.2483	5.5195	5.5202	5.5214
Methane	34.4428	84.9948	84.5665	85.0242
CO_2	0.8137	1.9973	1.9978	1.9980
Ethane	61.1936	4.2856	150.2470	4.2871
Total	100.0000	100.0000	245.5275	100.0346

9 Calibration Gas Certificate

Calibration gas certificate is a record of composition and uncertainty of a certified calibration gas package. These certificates usually come as a papers (hardcopies) or labels attached to the gas tank or canister. Calibration certificate module is required by Uncertainty Calculation module.

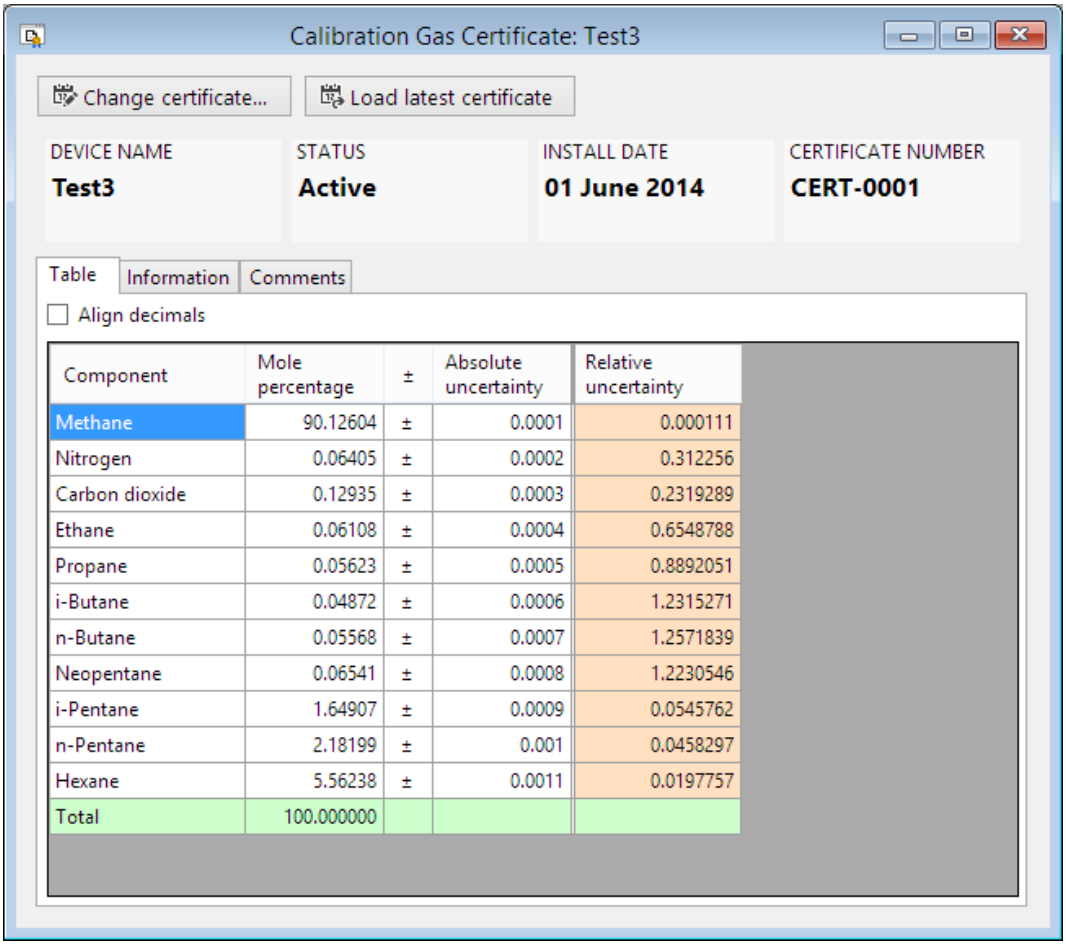
Note

To use Calibration Gas Certificate module, you need GCAS feature either *Calibration Gas Certificate* or *Uncertainty Calculation*, or *Uncertainty Trend* to be included in your licence.

GCAS feature *Calibration Gas Certificate* is given to customers who'd like to unlock Calibration Gas Certificate module but do not want the full Uncertainty Calculation module. If you purchased *Uncertainty Calculation* feature or *Uncertainty Trend*, you have access to Calibration Gas Certificate module automatically.

9.1 The *Calibration Gas Certificate* Form

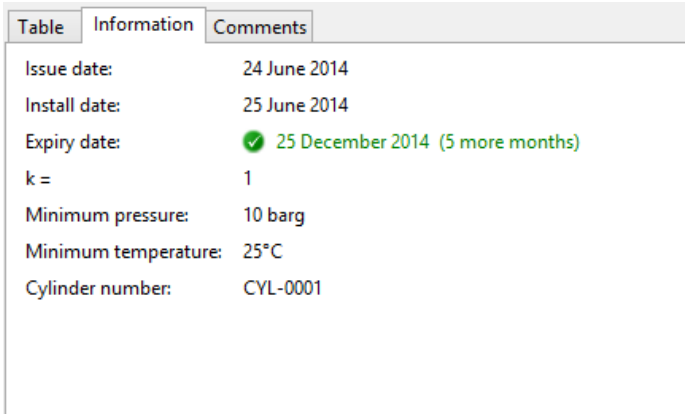
Calibration Gas Certificate form displays the content of a calibration certificate and its properties. To open Calibration Gas Certificate form, select a device on your device panel and go to the View menu > **Calibration Certificate**.



Calibration Gas Certificate form. Data in this screenshot is fictional, for illustration purpose only.

First tab is called **Table**; here you see all mole percentage values and their corresponding *absolute* uncertainty (as written on your paper certificate). It also shows the *relative* uncertainty which is calculated from your absolute uncertainty. This relative uncertainty is calculated at the *k* value (coverage factor) that is embedded in the certificate record in GCAS database. To find out what is the *k* value for this record, switch to the second tab. Relative uncertainty (also known as $\mathbf{U_{cal\ gas}}$) is a part of uncertainty calculation.

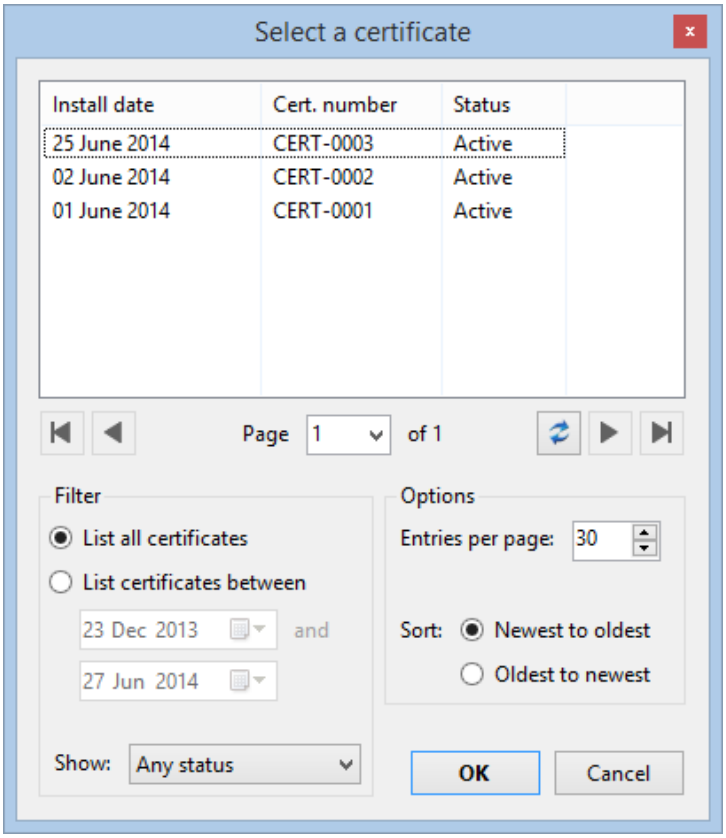
Second tab is **Information** where other properties of the certificate is listed. Third tab is **Comments**, which like the other forms in GCAS Desktop, displays user comments for the certificate.



The "Information" tab. Data is fictional.

9.2 View Previous Certificates

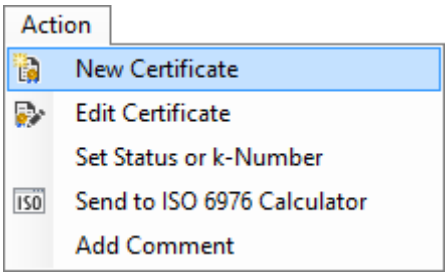
To view other calibration certificates, Click **Change certificate**. Select a different certificate, then click **OK** or double click the list item.



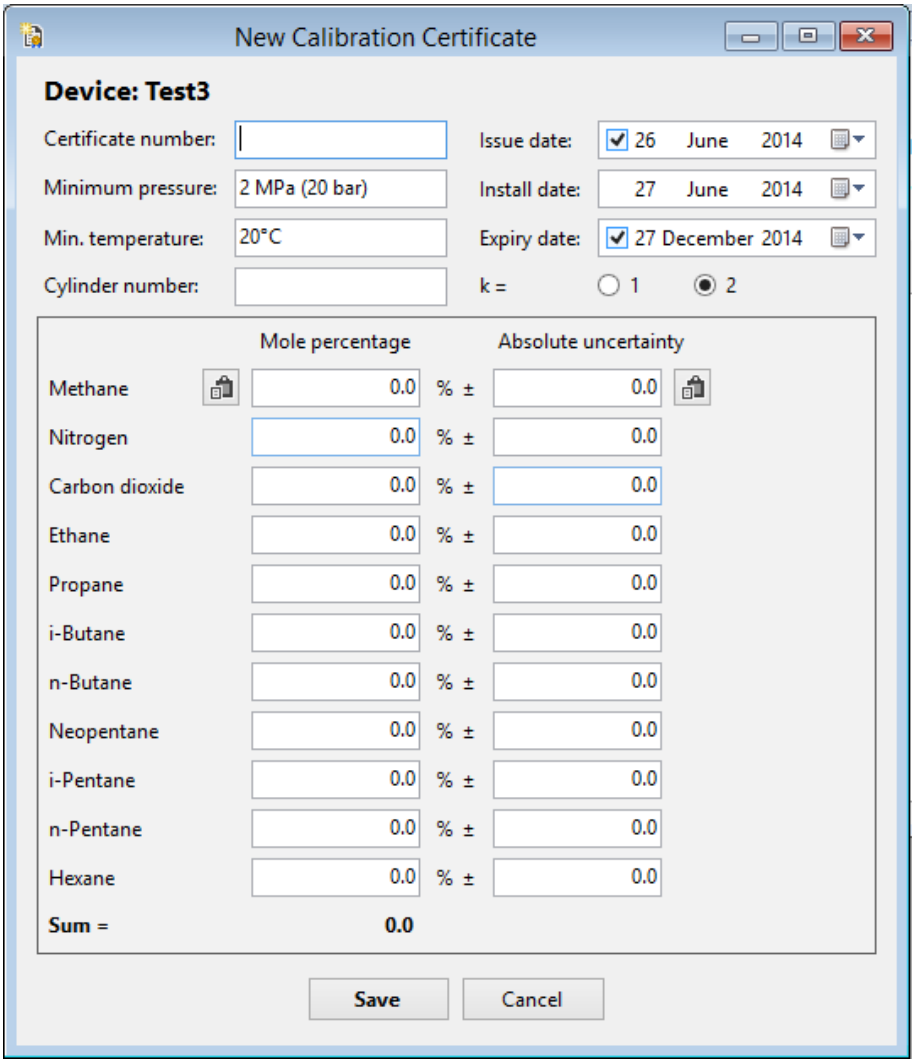
Click **Load latest certificate** to return to the most up-to-date certificate.

9.3 Input a New Certificate

As calibration certificates come as hardcopies, you need to enter the mole percentage and uncertainty values meticulously by hand. Open the Action menu and select **New Certificate**. If you do not see this menu, you may not have the action permission for it. Contact your GCAS Administrator.



The *New Calibration Certificate* entry form shall appear. Begin by entering certificate properties such as certificate number, issue date, install date, expiry date, minimum storage and/or usage pressure, minimum storage and/or usage temperature, cylinder/gas tank/canister serial number, and the *k* value (coverage factor).



Afterwards, enter the mole percentage and absolute uncertainty value of each gas in the certificate. Be alert for potential human error while typing. When you are confident with all entries, click **Save** to save the certificate record into database.

Note

Certificate number, *k* number (coverage factor) and install date must be specified. Other properties can have blank (null) data. Typically, the next calibration cycle after the certificate install date is a footprint.

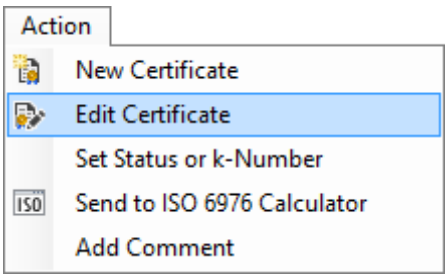
If the certificate does not specify minimum storage/usage pressure and temperature, set them blank. If the cylinder number is not available, leave it blank too. If there is no info about issue date and expiry date, untick the corresponding check box inside the date picker.

Unlike Mole Composition module which recognises any scale, calibration gas certificate must be expressed in percentage.

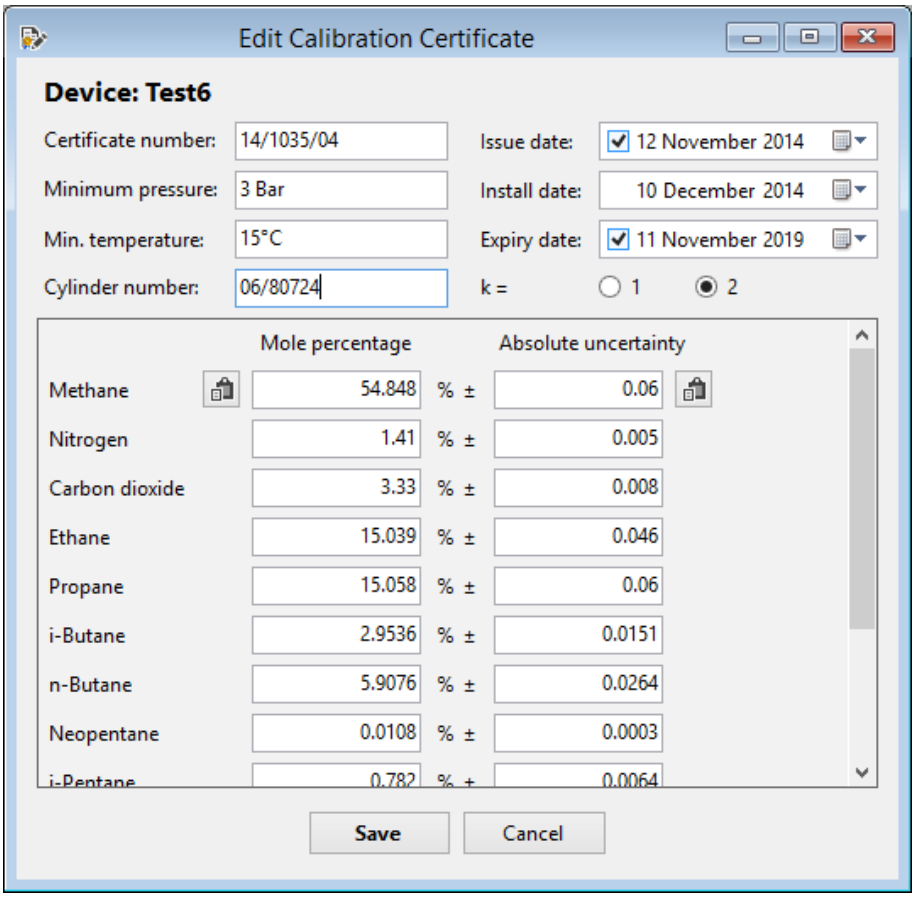
Like any other text box series in GCAS Desktop interface, you can paste numbers from Microsoft Excel or other spreadsheet processing software. Press `Ctrl+V` inside the **first text box** and the rest will follow. Alternatively, click **Paste**.

9.4 Edit a Certificate

Sometimes human errors happen. If you did a mistake when entering numbers in the previous chapter, go to the Action menu and select **Edit Certificate**. If you do not see this menu, you may not have the action permission for it. Contact your GCAS Administrator.



This menu brings forth *Edit Calibration Certificate* form which is the same form as *New Calibration Certificate* but its function now is to correct mistakes in the numbers. Correct every wrong value and then click **Save**.

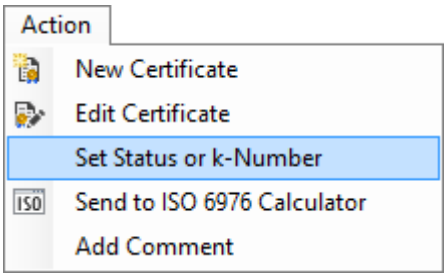


Although you can use *Edit Calibration Certificate* form to change the certificate install date, this can trigger unwanted side effect. If another certificate has already existed on the same date, GCAS Desktop will use whichever stored first in the database.

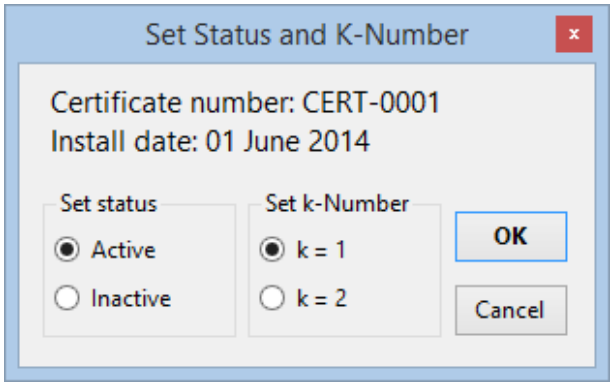
9.5 Change Certificate Status

Every certificate record has a status bit indicating whether the certificate is active or inactive. GCAS Desktop will not use inactive certificates in uncertainty calculation and ISO 10723 conversion.

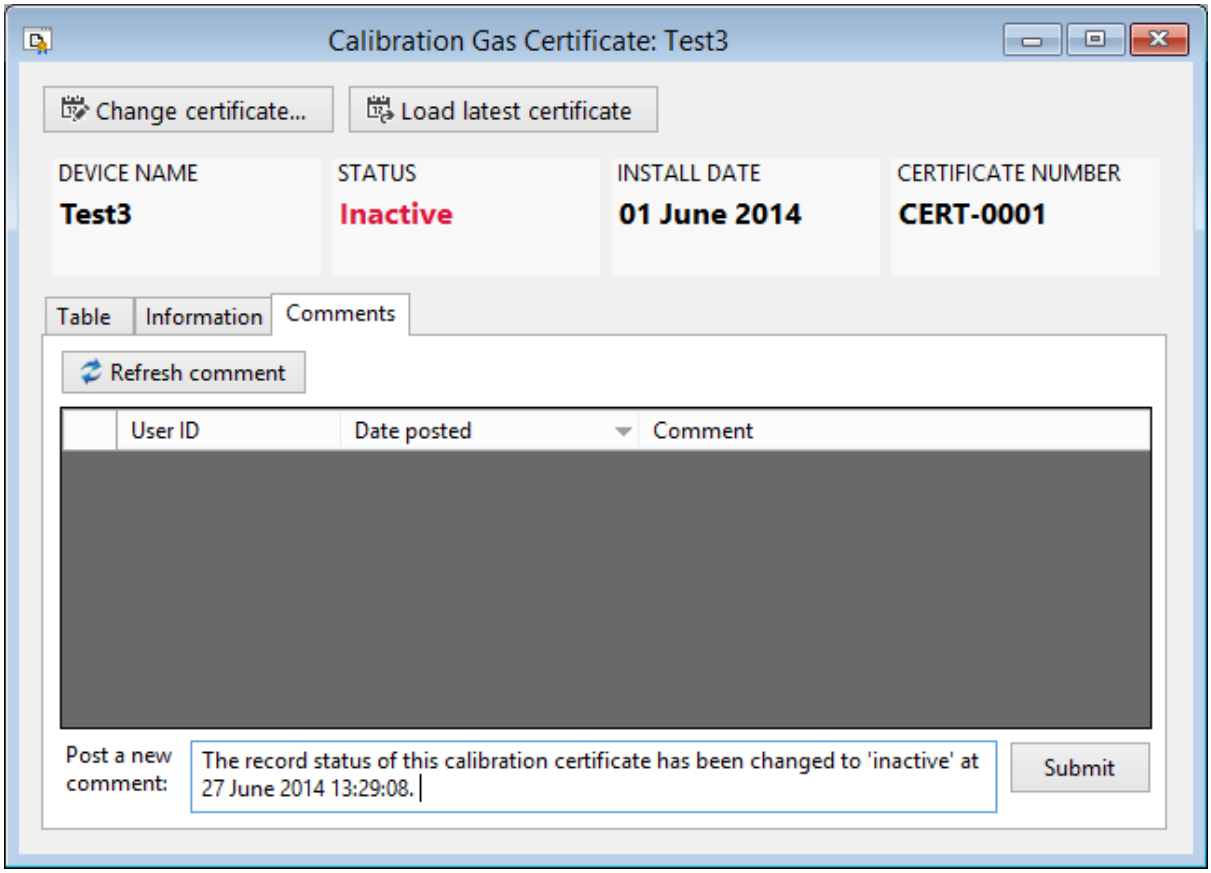
To change certificate status, open the Action menu and select **Set Status or k-Number**. If you do not see this menu, your GCAS user account does not have action permission for it.



This menu brings forth the *Set Status and k-Number* dialogue where you can flip records status from active to inactive or the other way round.

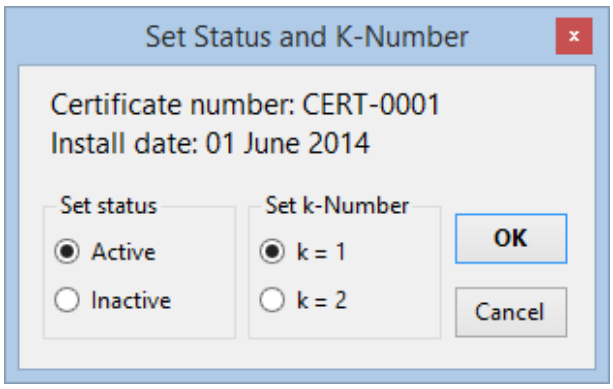


After you change the status, Calibration Gas Certificate form will reload the record and displays the new status at the top region of the form. It also switches to *Comments* and asks you to write a comment of why the status was changed. Comments tab does not open in case your GCAS user account doesn't have action permission to post comments.



9.6 Change *k* Number (Coverage Factor)

Use the same Action menu as the previous subchapter, **Set Status or k-Number**. This menu calls the *Set Status and k-Number* dialogue, then choose the new *k* value.



After you click **OK**, the form reloads the certificate and recalculates absolute uncertainty values according to the new coverage factor.

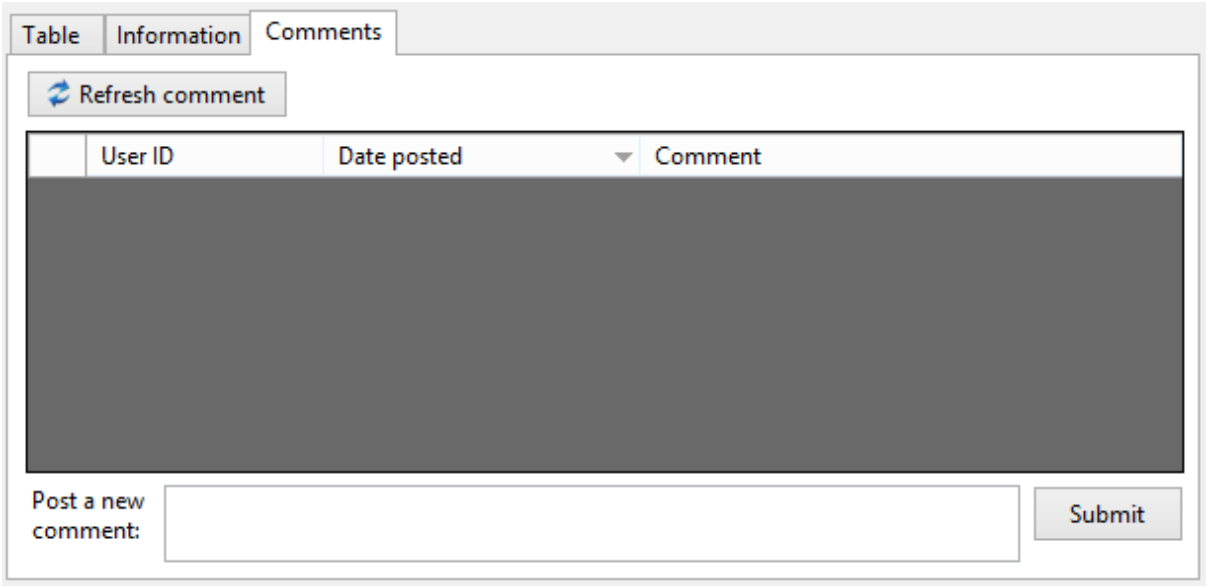
Component	Mole percentage	±	Absolute uncertainty
Methane	90.12604	±	0.0001
Nitrogen	0.06405	±	0.0002
Carbon dioxide	0.12935	±	0.0003
Ethane	0.06108	±	0.0004
Propane	0.05623	±	0.0005
i-Butane	0.04872	±	0.0006
Methane	0.05568	±	0.0007
Neopentane	0.06541	±	0.0008
i-Pentane	1.64907	±	0.0009
n-Pentane	2.18199	±	0.0010
Hexane	5.56238	±	0.0011
Total	100.00000		

Component	Mole percentage	±	Absolute uncertainty
Methane	90.12604	±	0.0002
Nitrogen	0.06405	±	0.0004
Carbon dioxide	0.12935	±	0.0006
Ethane	0.06108	±	0.0008
Propane	0.05623	±	0.0010
i-Butane	0.04872	±	0.0012
Methane	0.05568	±	0.0014
Neopentane	0.06541	±	0.0016
i-Pentane	1.64907	±	0.0018
n-Pentane	2.18199	±	0.0020
Hexane	5.56238	±	0.0022
Total	100.00000		

Calibration certificate on k = 1 (left) and k = 2 (right). Data is fictional.

9.7 Insert Comment

If you need to put notes or other properties that were not supported by New Calibration Certificate form, post them in comments.

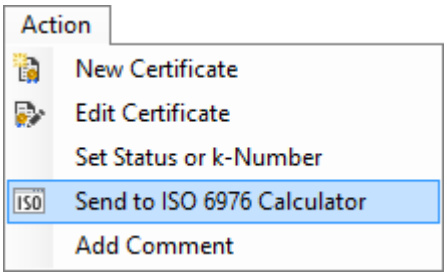


1. Open the **Comments** tab or go to Action menu > **Add Comment**.
2. Write your comment on the text box at the lower section of the form, then click **Submit**.
3. Make sure the comment is correct (e.g. free from spelling errors) because once inserted into database, you will not be able to remove the comment.

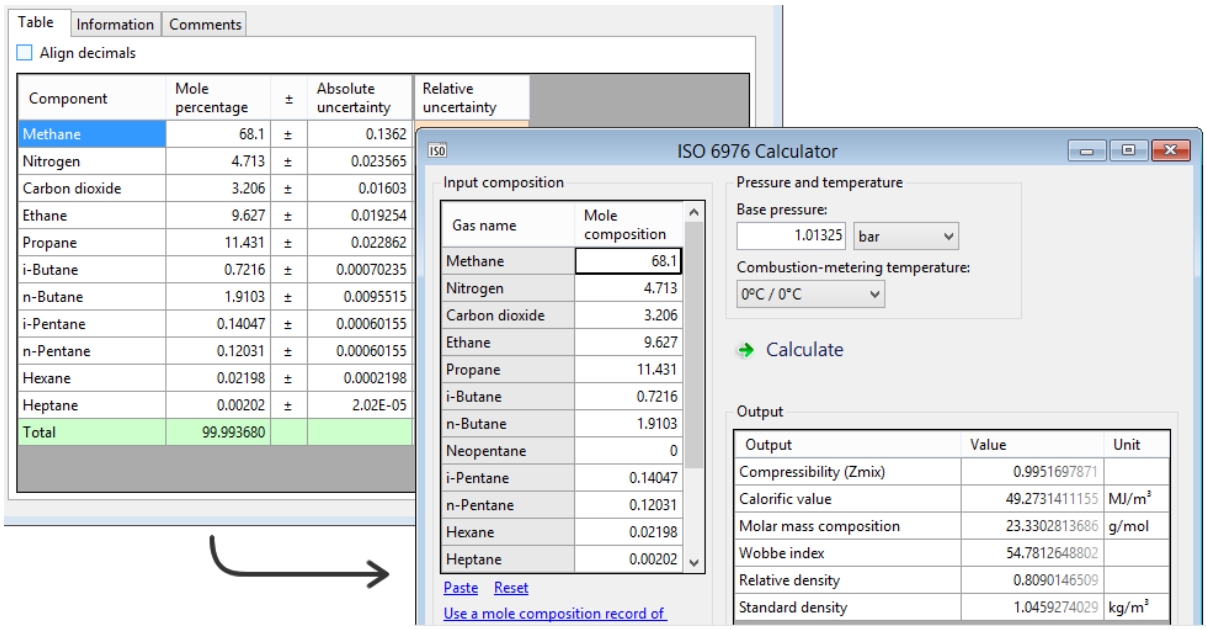
If you do not see the textbox and the Submit button, i.e. the comment grid fills up the entire form, your user account may not have action permission to write comments or your user role is *Read-only*. Contact your GCAS administrator.

9.8 Send to ISO 6976 Calculator

Although this feature is rarely used, calibration certificates *do* have mole composition. This means GCAS can calculate the calorific value and other properties of a calibration gas composition. Users whose GCAS licence includes GCAS feature *ISO 6976 Calculator* shall see an additional action menu **Send to ISO 6976 Calculator**.



Similar to ISO 6976 Calculation menu on mole composition, this menu sends the mole composition part of the calibration certificate to ISO 6976 Calculator tool. Then it calculates the calorific value (CV) and other properties automatically.



10 Data Analysis

Data Analysis is a tool to see trend of GC parameters over time in history.

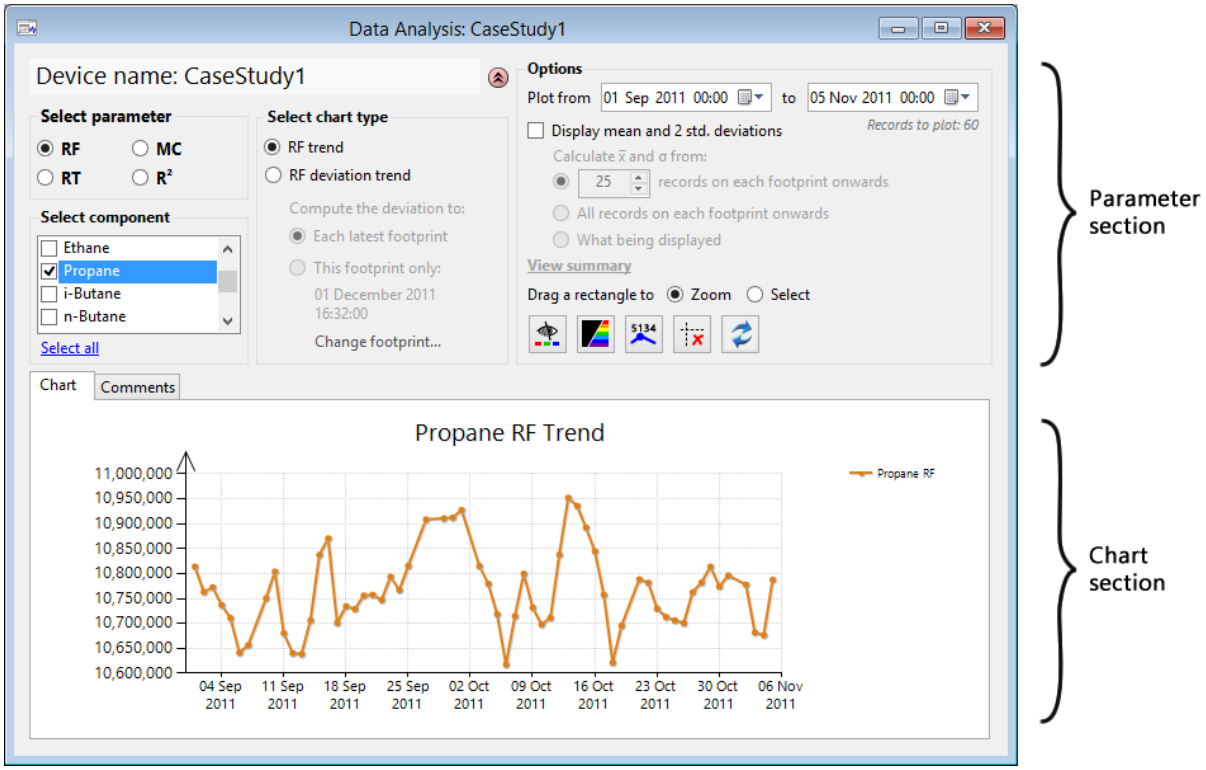
Note

This module requires GCAS feature *Data Analysis* to be included in your GCAS licence.

Data Analysis works for one device as it displays trends of various data for one device. The complement of Data Analysis is called *Data Comparison*, which for the time being is only implemented as Mole Composition Comparison. Working at the opposite of Data Analysis, Mole Composition Comparison displays mole composition trends of one data (gas) for various devices.

10.1 The *Data Analysis* Form

Select the desired GC device on the device panel, then go to the View menu > **Data Analysis**. The form consists of three sections: parameters, chart, and comments.

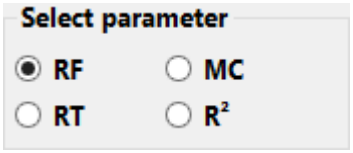


Parameters section at the top is where you set everything in order to get the chart you want. **Chart** section at the bottom graphs the chart. **Comments** tab is the place to write your comment.

10.2 Parameters, Chart Types, and Components

This chapter explains the contents of the **parameter** section of Data Analysis form.

10.2.1 Parameters



This is the main switch to select which parameter to be graphed on the chart. Users can graph the following parameters:

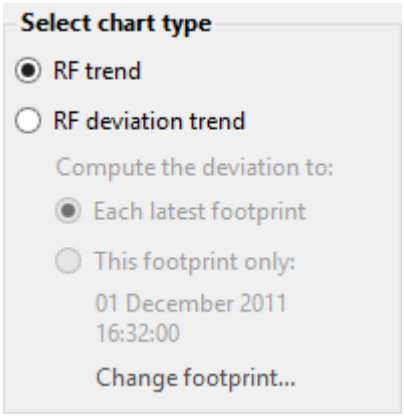
1. **RF** - Response factor
2. **RT** - Retention time
3. **MC** – Mole composition
4. **R^2** - Correlation parameter

If you see the **MC** (mole composition) option is disabled, it means you do not have *Live Data Analysis* feature in your GCAS licence.

10.2.2 Chart Types

Chart Types are more specialised options for the selected parameter. Available chart types vary, depending on the selected parameter.

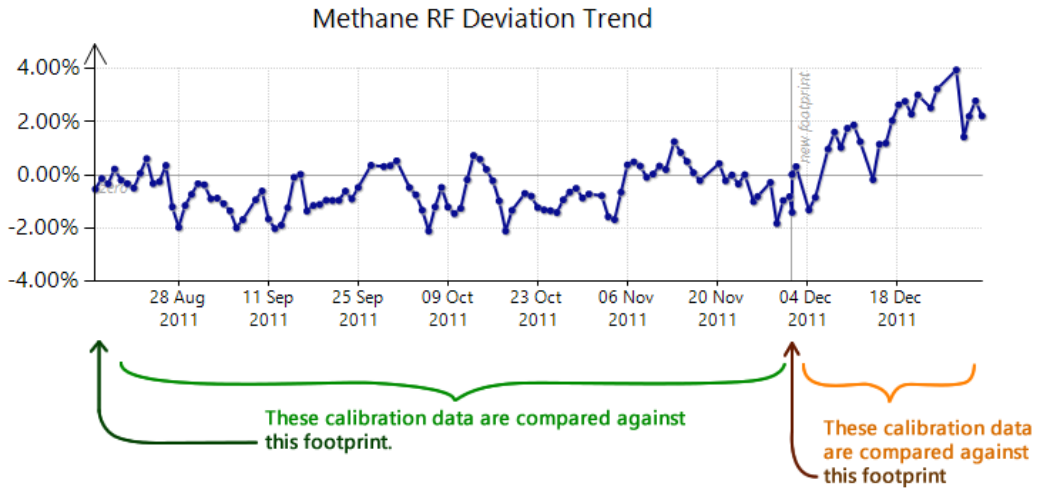
10.2.2.1 Selected parameter: RF (response factor)



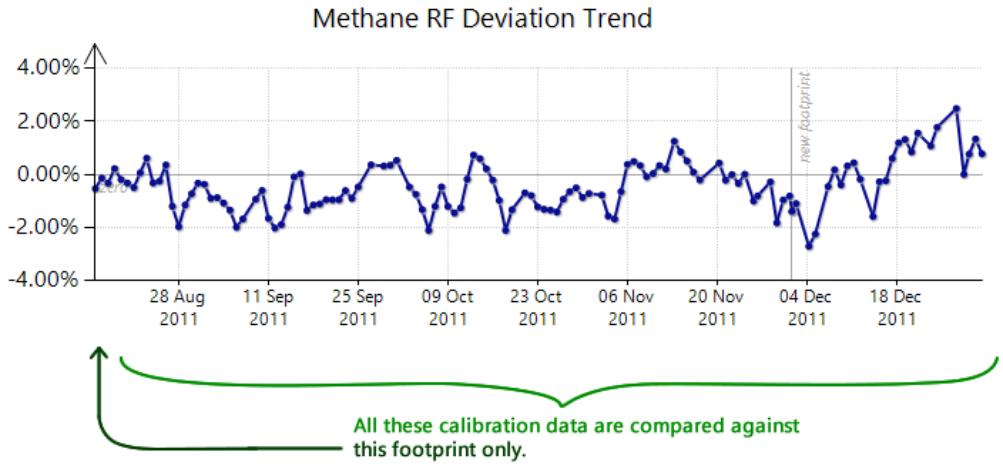
These options show up when the selected parameter is **response factor** (RF).

1. **RF trend** graphs the **actual** response factor values over time in history.
2. **RF deviation trend** graphs the **deviation** (difference) of RF values against footprints in percentage. This gives further options which are:

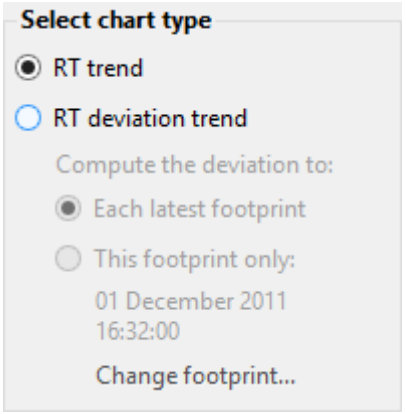
- **Each latest footprint**: Each RF value is compared against its latest footprint.



- **This footprint only**: All RF values are compared against a particular footprint value. The footprint to set as the comparison base is configurable through **Change footprint** link.



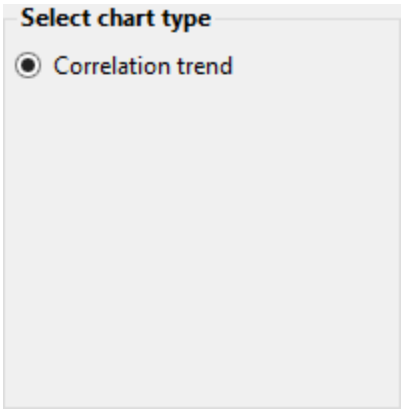
10.2.2.2 Selected parameter: RT (retention time)



These options show up when the selected parameter is retention time (RT). They are very similar to RF chart types.

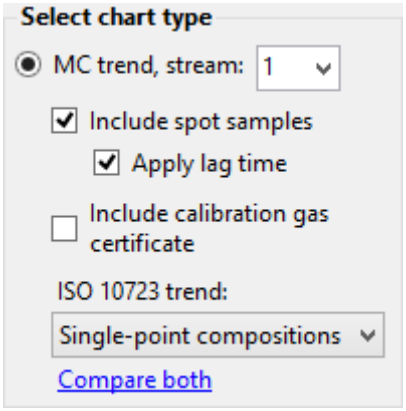
1. **RT trend** graphs the **actual** retention values over time in history. The unit of measurement is second (s).
2. **RT deviation trend** graphs the **deviation** (difference) of RT values against footprints, also in seconds (s). This also gives two further options:
   - **Each latest footprint**: Each RT value is compared against its latest footprint similar to RF deviation chart.
   - **This footprint only**: All RT values are compared against a particular footprint value. The footprint to set as the comparison base is configurable through **Change footprint** link.

10.2.2.3 Selected parameter: R^2 (correlation)



The chart will only show the actual value of R^2 calculations. This parameter is not compared against footprint values, but against a low alarm limit. The low alarm limit is configured in the Analysis Parameter form. If it is not set, the default limit **0.995** is used.

10.2.2.4 Selected parameter: MC (mole composition)



The chart will graph mole composition values of the selected stream. Refer to the user manual of your GC device to know which stream numbers deliver mole percentage data.

Available stream numbers are determined from data that has been existed in database and also the mole composition stream definition in Register Mapping form. If you know there is a stream number

that is not on this dropdown list yet, simply type the stream number on the dropdown box manually then click the **Refresh** button or press F5.

You can also display spot sample records and/or calibration gas certificate alongside the regular mole composition record on the chart. Spot samples are displayed as triangles, calibration certificates are displayed as *bigger* triangles, while regular mole composition values appear as ordinary line charts. Tick the corresponding check box to show or hide these special records.

Apply lag time is currently non-functional. In future version of GCAS Desktop where the device-level lag time module has been developed, this check box will shift all spot sample dots to the right according to the amount of calculated lag time. Thus, the triangle is closer to the regular mole composition line chart or even co-incide. This way you can see if the spot sample dot and the line is far apart in terms of Y-axis value, it indicates problems within your pressure letdown system.

Users with GCAS feature *ISO 10723* included in their licences see an additional dropdown selection **ISO 10723 trend**. This dropdown contains three options:

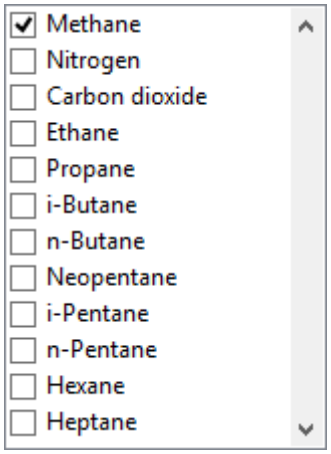
- **Single-point compositions** converts any multilevel-calibrated records within the plot range into single-point compositions before graphing them to the chart. Records already marked as single-point are plotted as usual.
- **MLC compositions** converts any single-point records within the plot range into multilevel-calibrated compositions before graphing them to the chart. Records already marked as multilevel-calibrated are plotted as usual.
- **Don't convert** ignores the MLC flag bit and plots all records within the plot range as they are. Use this if you have slow network connection to the database server and you are confident that this GC device never have mixed MLC records and single-point records. Never select this option if you are unsure whether the device has mixed MLC flag bit as it will produce invalid MC trend chart.

Users with both GCAS feature *ISO 10723* and *Data Comparison* included in their licences see a link **Compare both** below the ISO 10723 trend dropdown. This link is available if only one gas is selected. It calls Mole Composition Comparison form, sends the selected gas, date/time range, and stream number, then instructs Mole Composition Comparison form to compare single-point versus MLC compositions. If the single-point and MLC curves are overlap or very close to each other, your GC is more likely in a good condition. If they drift too far, your GC has too much *bias* and it will increase the uncertainty value.

10.2.3 Components

Components are selections of available gases to draw on the chart. In most use, usually only one gas is selected. GCAS Desktop can display multiple gases on one chart as required.

10.2.3.1 Selected parameter: RF or RT



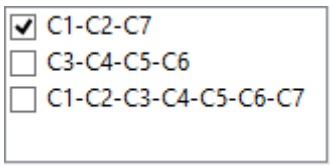
Components for C7-complete devices.

Depending on your GC device type, you would see between 10 to 15 gases. C6-without-neopentane have ten gases, while C10-complete devices have fifteen.

10.2.3.2 Parameter selected: MC (mole composition)

You should see all gases as in RF or RT, with one additional component at the bottommost of the list: **Unnormalised total**. GCAS Desktop always graphs *normalised* mole composition chart for gas component — except for, obviously, the unnormalised total.

10.2.3.3 Parameter selected: R^2 (correlation)



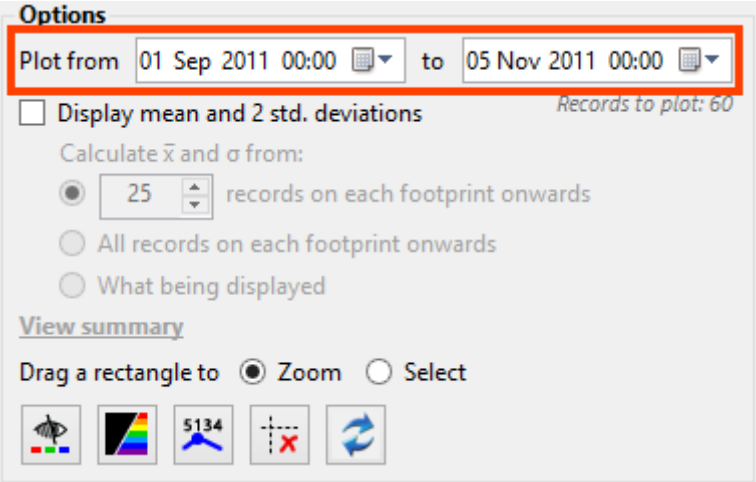
For R^2 parameter, you should see two or three items. Depending on your GC device type, the wording of these components may vary. These components graphs different R^2 values calculated from their RF-MW logarithm computation.

Device type	Available components
Daniel C6+ complete or C6+ without neopentane	C1-C2-C6 C3-C4-C5 C1-C2-C3-C4-C5-C6
Daniel C7+ complete or C7+ without neopentane	C1-C2-C7 C3-C4-C5-C6 C1-C2-C3-C4-C5-C6-C7
Daniel C9+ complete or C9+ without neopentane	C3-C4-C5 C6-C7-C8-C9
Daniel C10+ complete or C10+ without neopentane	C3-C4-C5-C6 C7-C8-C9-C10

ABB C6+ complete or C6+ without neopentane	C3-C4-C5 C4-C5-C6 C3-C4-C5-C6
ABB C7+ complete or C7+ without neopentane	C3-C4-C5-C6 C4-C5-C6-C7 C3-C4-C5-C6-C7

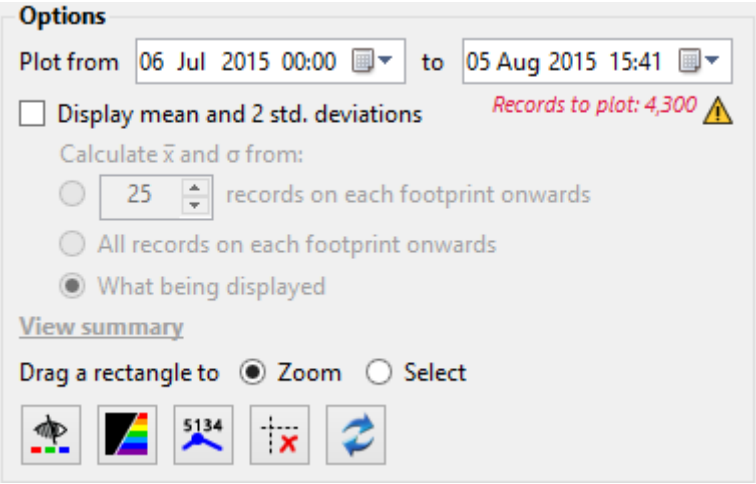
10.3 Date and Time Range (Plot Range)

When you open the Data Analysis form, it tries to load data from the last 30 days. To change this date and time range, set the desired range using the two date pickers inside the options box. The time uses 24-hour format. Click **Refresh** button to reload the chart.



When the chart is refreshed, chart data is cached in computer memory. So if you select or unselect some components, the requested data is loaded from memory instead of database as long as date and time range does not change. Everytime you push the refresh button, it also refreshes this cache. Cache is cleared when the form is closed.

GCAS Desktop counts how many records are to be displayed, and displays this count under the date picker input fields. Would there be too many records to load, GCAS Desktop alerts you that the load-and-draw process may take a prolonged time. Also, the dots of the line chart may clutter the chart area thus makes it difficult to interpret. Alert limit is hardcoded to 150 records for RF, RT, and MC; and 100 records for R^2.



10.4 Mean and Standard Deviations

On certain parameters, GCAS Desktop can calculate the mean (average) and twice the standard deviations. The table below describes which parameter has this capability.

Parameter	Mean & 2 std.dev enabled?	Available options
RF	Yes	1. *x* records from footprint, 2. All records from footprint, 3. What being displayed
RT	Yes	1. *x* records from footprint, 2. All records from footprint, 3. What being displayed
MC	Yes	1. What being displayed
R^2	No	None

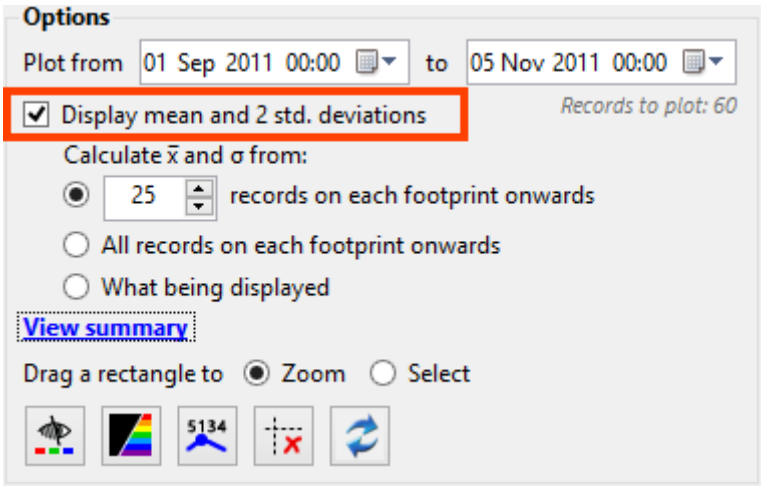
Note

GCAS Desktop can only calculate mean and standard deviations if only one component is selected. Mean and standard deviations cannot be computed for two or more active components on the chart.

Important

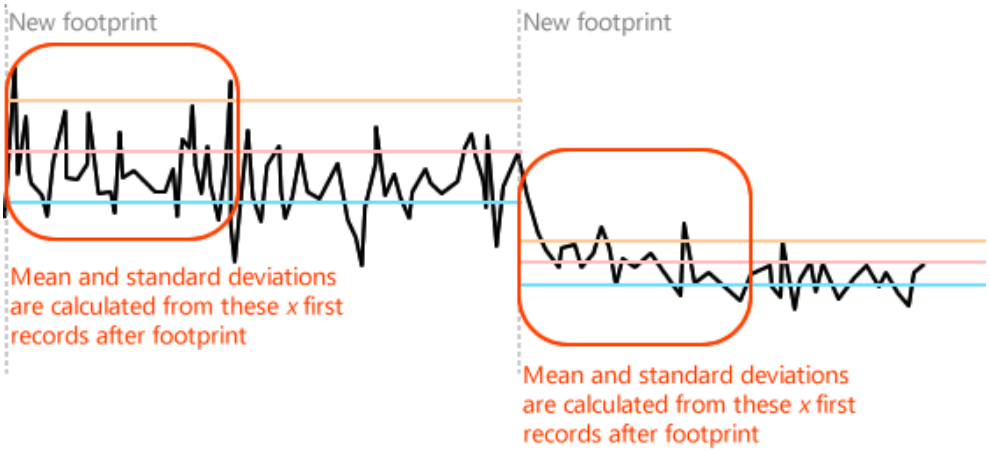
If you are working offline, computed mean and standard deviations may not be accurate because it depends on how much data available on your temporary database. GCAS Desktop displays offline warning icon to alert this potential source of inaccuracy. Try to stay in online mode as much as possible while working with Data Analysis.

To show or hide the mean and twice standard deviations, use the checkbox **Display mean and ± 2 × standard deviations**.

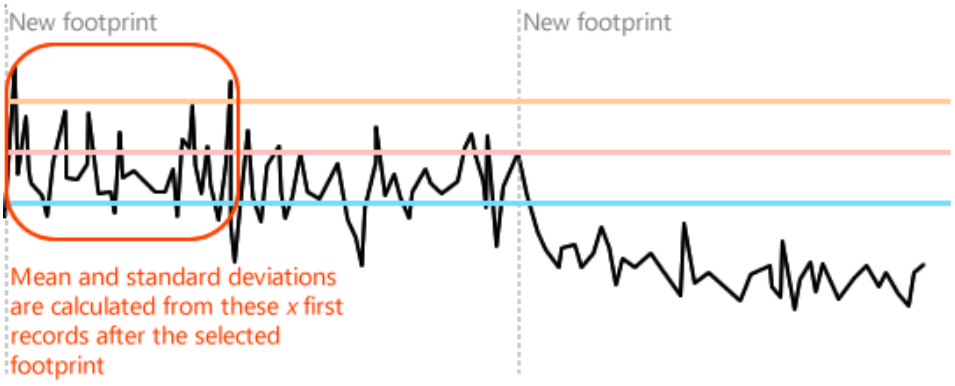

Options
Plot from 01 Sep 2011 00:00 to 05 Nov 2011 00:00
Records to plot: 60
Display mean and 2 std. deviations
Calculate x̄ and σ from:
25 records on each footprint onwards
All records on each footprint onwards
What being displayed
View summary
Drag a rectangle to Zoom Select
5134

There are three options for mean and standard deviation calculation.

a) ***x* records from footprint** (default *x* = 25 records)
Mean and twice standard deviations are calculated from first *x* records (default is 25) after each footprint.

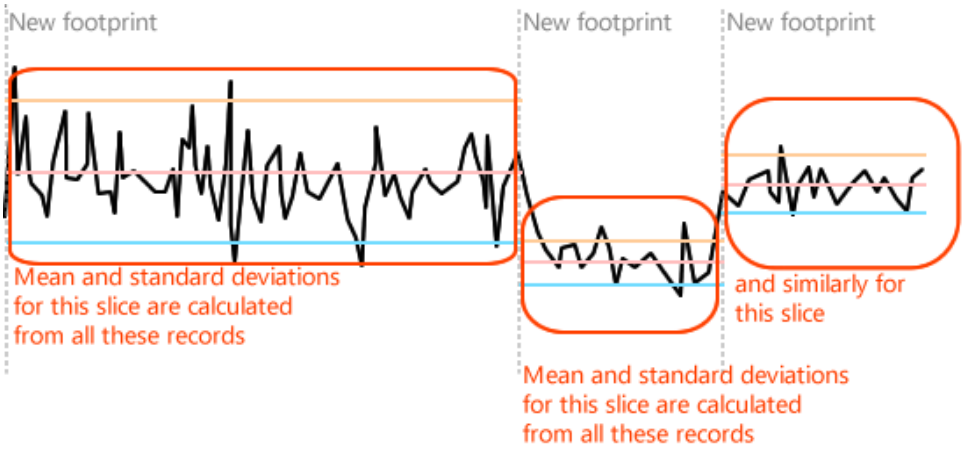

New footprint
New footprint
Mean and standard deviations are calculated from these x first records after footprint
Mean and standard deviations are calculated from these x first records after footprint

Special case if you are drawing RF or RT *deviation trend* and you have chosen a particular footprint as a comparison base, this option will calculate the mean and twice the standard deviations from *x* records after that footprint only.

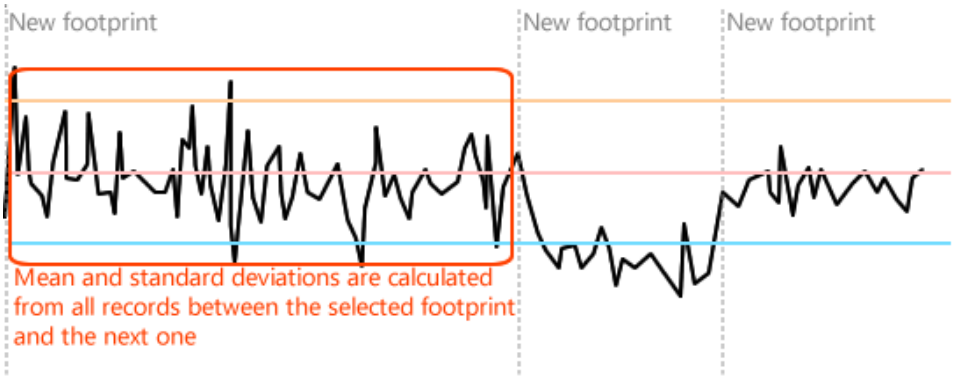

New footprint
New footprint
Mean and standard deviations are calculated from these x first records after the selected footprint

b) All records from footprint

Mean and twice standard deviations are calculated from all records between footprints.



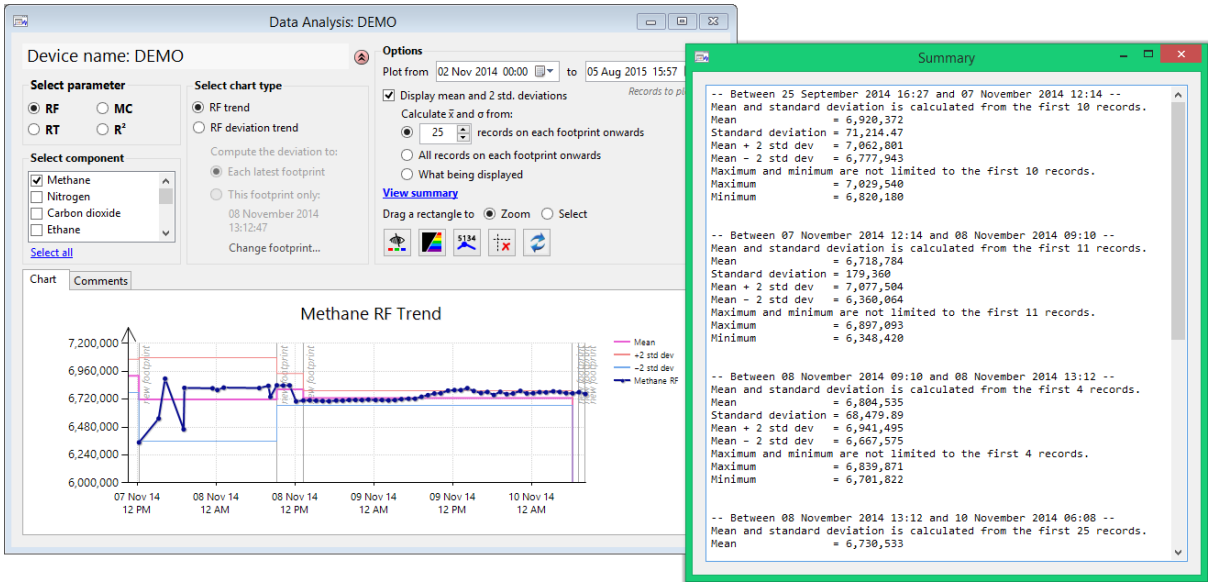
Special case if you are drawing RF or RT *deviation trend* and you have chosen a particular footprint as a comparison base, this option will calculate the mean and twice the standard deviations from all records between the selected footprint and one next footprint thereafter.



c) What being displayed

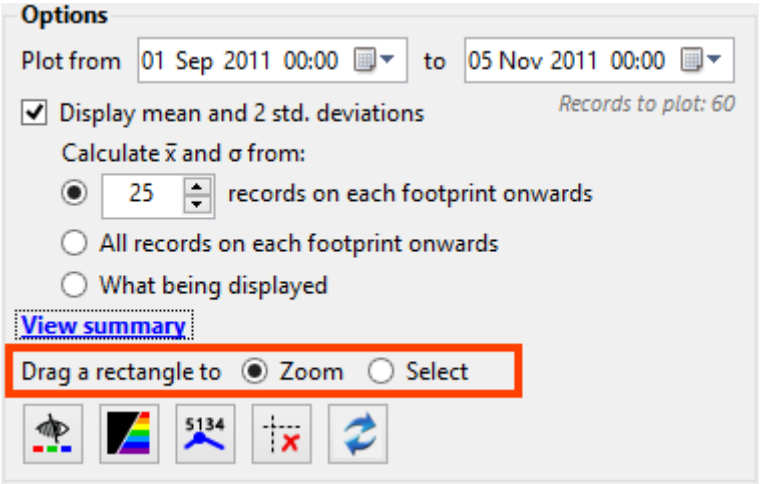
The mean and twice standard deviations are simply calculated from all the data points which have been drawn on the chart for your choice of date range. Unlike the other two options which require database reload through the **Refresh** button, this option uses the data already there on the chart area.

In addition, GCAS Desktop provides simple statistics when mean and standard deviation lines are on. Click **View summary** link below the three radio buttons, then the Data Analysis form generates a statistics summary for you.

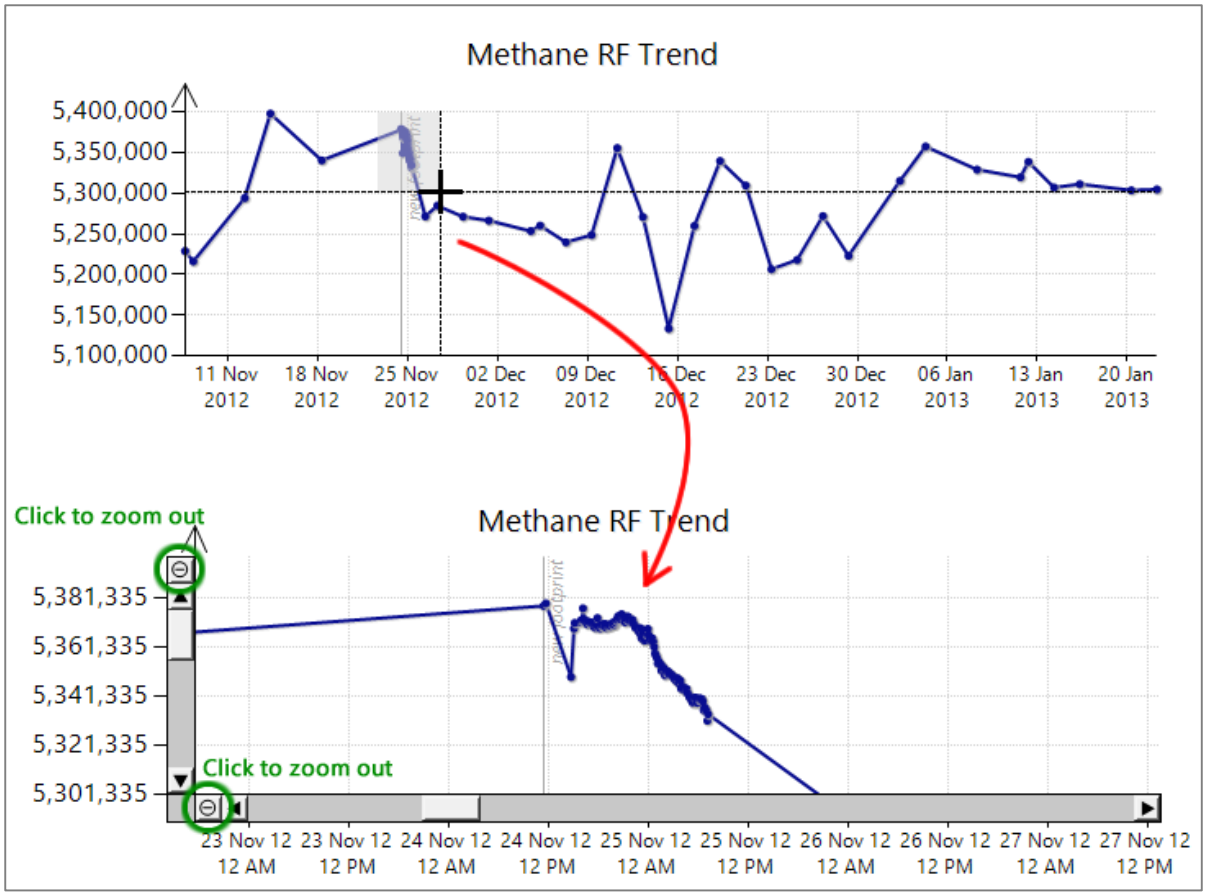

Data Analysis: DEMO
Device name: DEMO
Select parameter
RF
MC
RT
R²
Select component
Methane
Nitrogen
Carbon dioxide
Ethane
Select all
Select chart type
RF trend
RF deviation trend
Compute the deviation to:
Each latest footprint
This footprint only:
08 November 2014 13:12:47
Change footprint...
Options
Plot from 02 Nov 2014 00:00 to 05 Aug 2015 15:57
Display mean and 2 std. deviations
Calculate x̄ and σ from:
25 records on each footprint onwards
All records on each footprint onwards
What being displayed
View summary
Drag a rectangle to Zoom Select
Chart
Comments
Methane RF Trend
7,200,000
6,960,000
6,720,000
6,480,000
6,240,000
6,000,000
07 Nov 14 12 PM
08 Nov 14 12 AM
08 Nov 14 12 PM
09 Nov 14 12 AM
09 Nov 14 12 PM
10 Nov 14 12 AM
Mean
+2 std dev
-2 std dev
Methane RF
Summary
-- Between 25 September 2014 16:27 and 07 November 2014 12:14 --
Mean and standard deviation is calculated from the first 10 records.
Mean = 6,920,372
Standard deviation = 71,214.47
Mean + 2 std dev = 7,062,801
Mean - 2 std dev = 6,777,943
Maximum and minimum are not limited to the first 10 records.
Maximum = 7,029,540
Minimum = 6,820,180
-- Between 07 November 2014 12:14 and 08 November 2014 09:10 --
Mean and standard deviation is calculated from the first 11 records.
Mean = 6,718,784
Standard deviation = 179,360
Mean + 2 std dev = 7,077,504
Mean - 2 std dev = 6,360,064
Maximum and minimum are not limited to the first 11 records.
Maximum = 6,897,093
Minimum = 6,348,420
-- Between 08 November 2014 09:10 and 08 November 2014 13:12 --
Mean and standard deviation is calculated from the first 4 records.
Mean = 6,804,535
Standard deviation = 68,479.89
Mean + 2 std dev = 6,941,495
Mean - 2 std dev = 6,667,575
Maximum and minimum are not limited to the first 4 records.
Maximum = 6,839,871
Minimum = 6,701,822
-- Between 08 November 2014 13:12 and 10 November 2014 06:08 --
Mean and standard deviation is calculated from the first 25 records.
Mean = 6,730,533

10.5 Zoom Mode and Selection Mode

This switch controls whether the chart is in *zoom mode* or *selection mode*. **Zoom mode** lets you zoom in to a particular area of the chart in case there are too many data points cramped on small area. **Selection mode** allows you to drag a rectangle to select a pack of data points and manipulate them using the available context menus.


Options
Plot from 01 Sep 2011 00:00 to 05 Nov 2011 00:00
Records to plot: 60
Display mean and 2 std. deviations
Calculate x̄ and σ from:
25 records on each footprint onwards
All records on each footprint onwards
What being displayed
View summary
Drag a rectangle to Zoom Select
5134

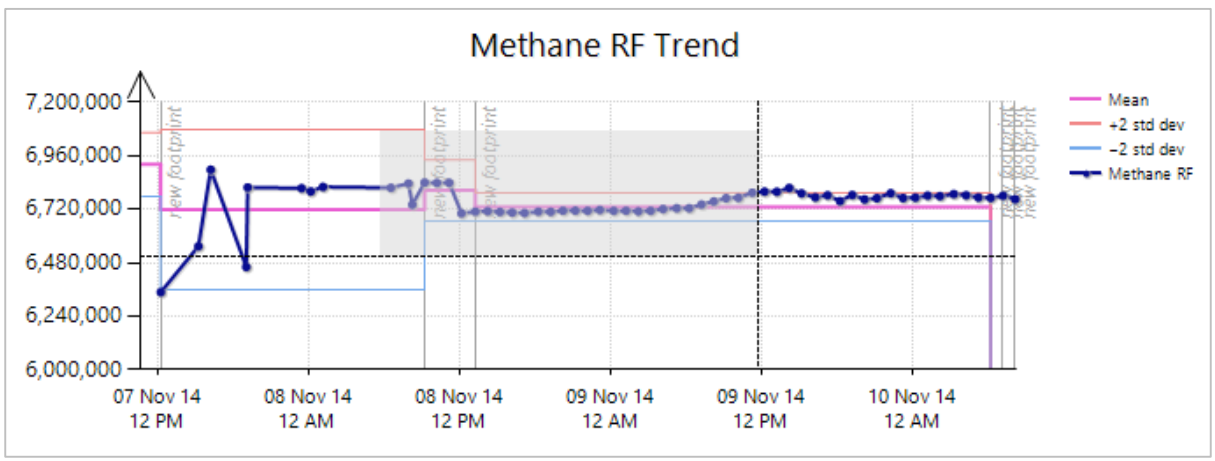
In *zoom mode*, drag a rectangle on the region you would like to zoom.



Use the scroll bars to pan the zoomed chart. To zoom in further, drag another rectangle on the area you would like to enlarge more.

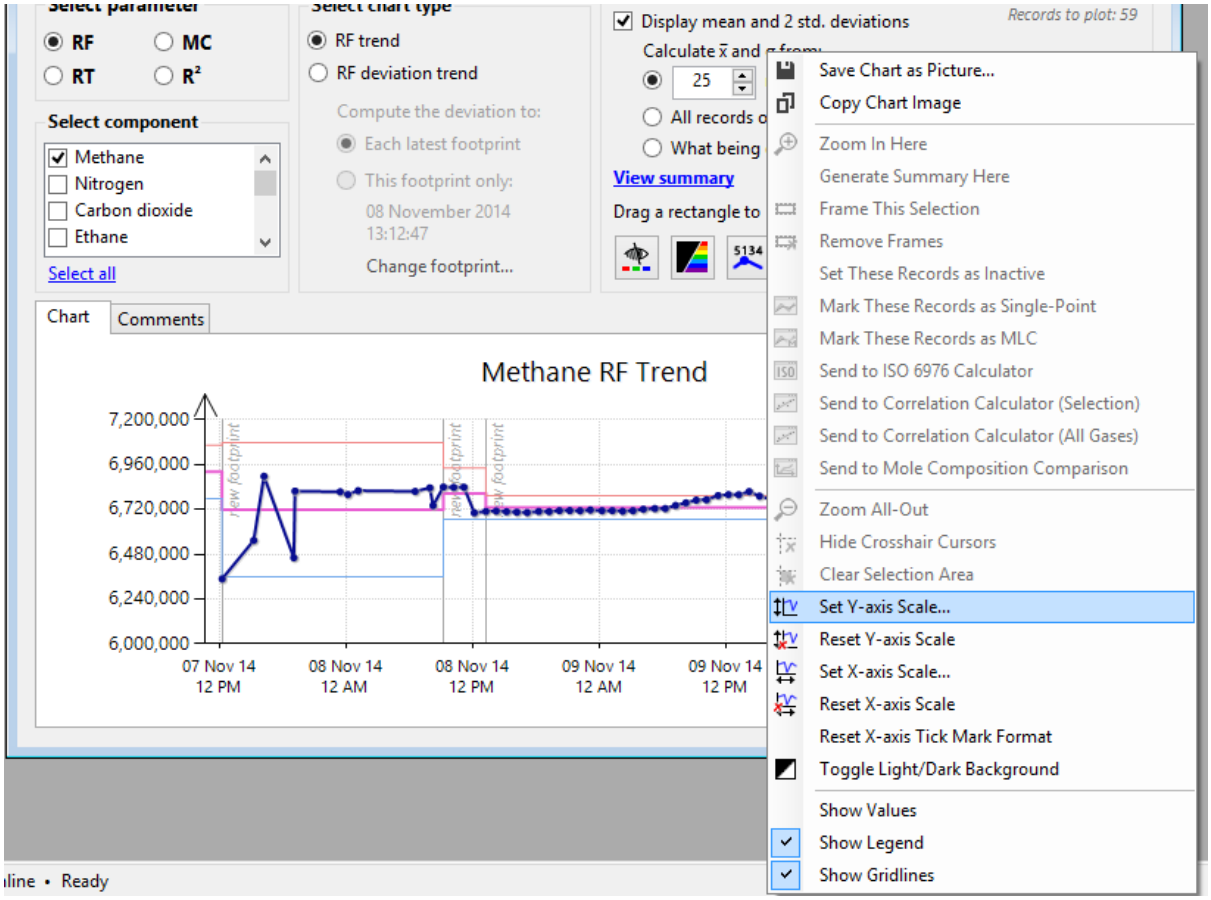
Click on the circled minus button Θ on both scroll bars to zoom out one step. To zoom all-out, simply press the Home button on your keyboard. Otherwise, right-click on the chart and select **Zoom All Out** submenu.

In *selection mode*, drag a rectangle to select an area on the chart. Right click the selection to open context menus and you see several menus available in selection mode. Chapter 10.9 will explain each function of these menus. To cancel selection, right click the chart and choose **Clear Selection Area**.



10.6 Change Axes Scale

When zoom is not enough, you can enforce a custom range for both X-axis and Y-axis of the chart. To do this, right click on the chart and select either **Set X-axis Scale** or **Set Y-axis Scale**.



For Y-axis, specify the desired numeric range. The input fields accept decimal values. For example, take the chart screenshot above and let us enter this range:

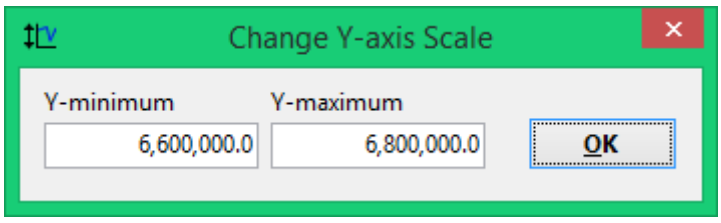
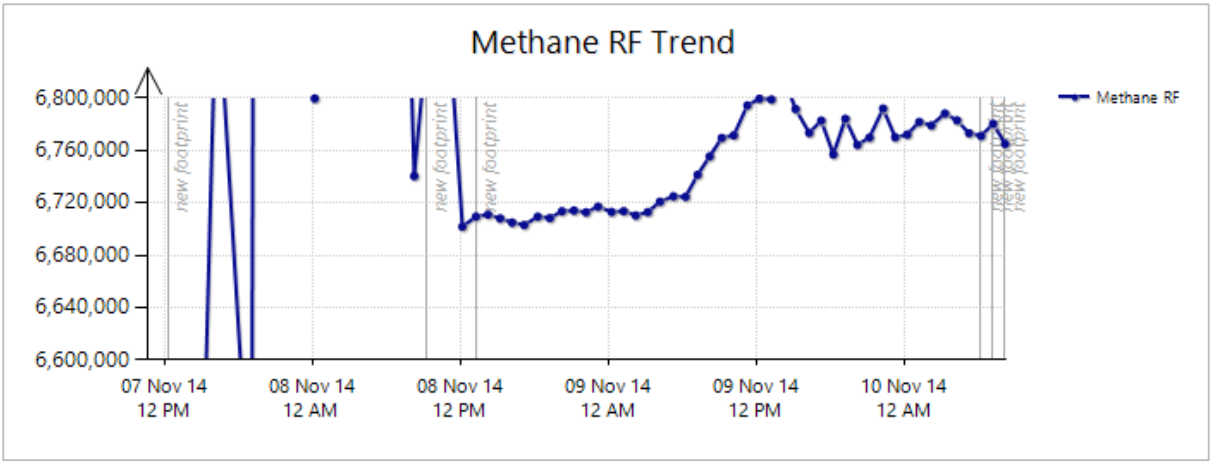
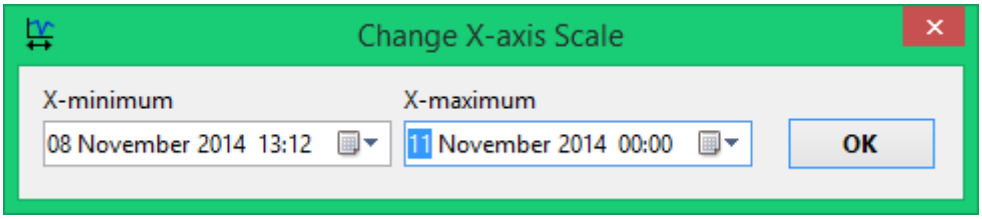


Chart is then drawn within the new, confined range similar to the screenshot below. Notice that the chart line is truncated because there are data points having values outside of this range.



To revert back to the automatic scale, right click the chart and select **Reset Y-axis scale**.

For X-axis, specify the desired date and time interval.

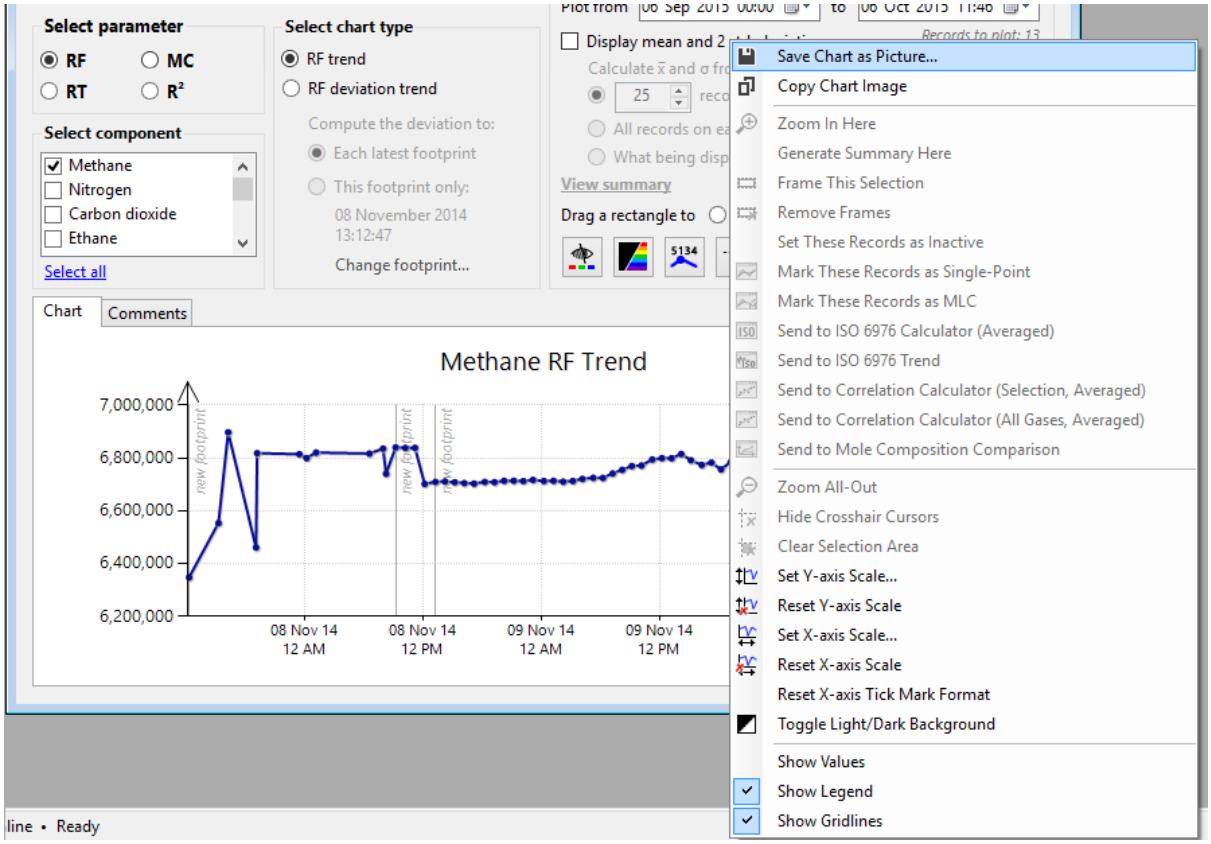


Similarly, to undo the scale you would right click on the chart and select **Reset X-axis scale**.

Depending on the custom date interval, the date mark on the X-axis may include the time. For more detailed interval such as from 00:00 to 08:00 of the same day, the X-axis would display the date and the time (hh:mm:ss) as well. When you reset X-axis scale but you notice the date/time marks on X-axis do not reset, right click on the chart and choose **Reset X-axis Tick Mark Format**.

10.7 Save or Copy the Chart

To save the chart as image file, right click on the chart and select **Save Chart as Picture**.



To copy the chart, right click and select **Copy Chart Image**. Then you may paste the image into Microsoft Paint, Microsoft Office, or any software that accepts bitmap image/picture data on clipboard.

Tips before saving or copying

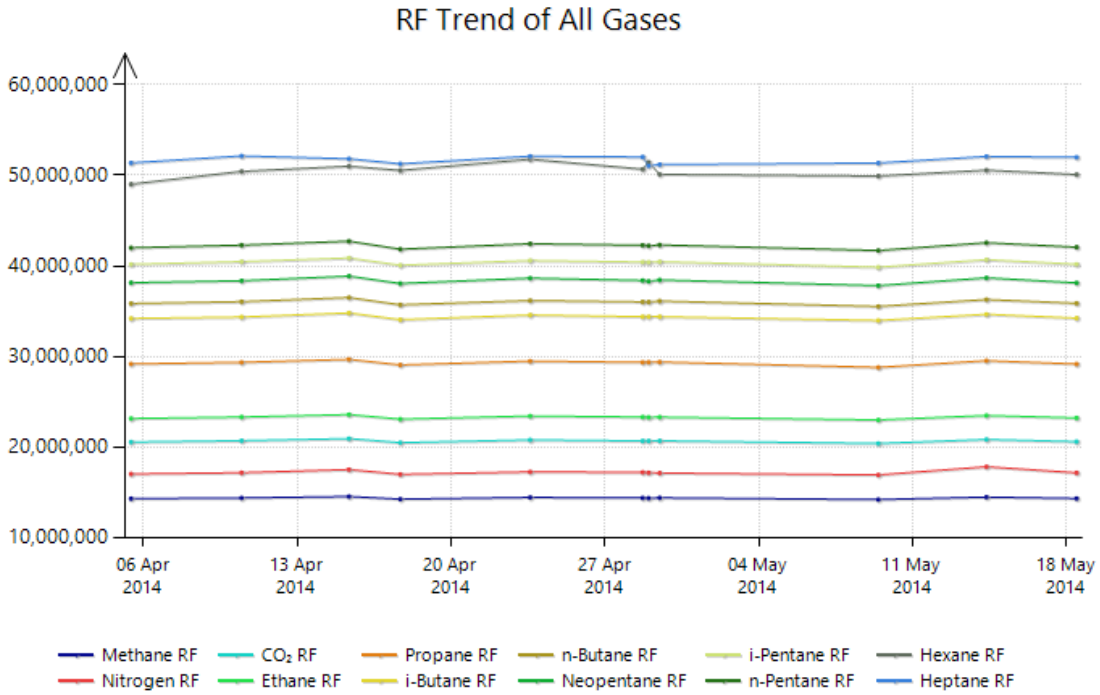
Enlarge the chart by maximising the Data Analysis form, collapsing the device panel, and expanding the chart area through the **Expand** button at the top of Data Analysis form.

To make the line chart black, use the toggle colour/black button on the options box. This button is available if only one component is ticked. Black line appears better on monochrome printers if the saved file or copied image is about to be printed.

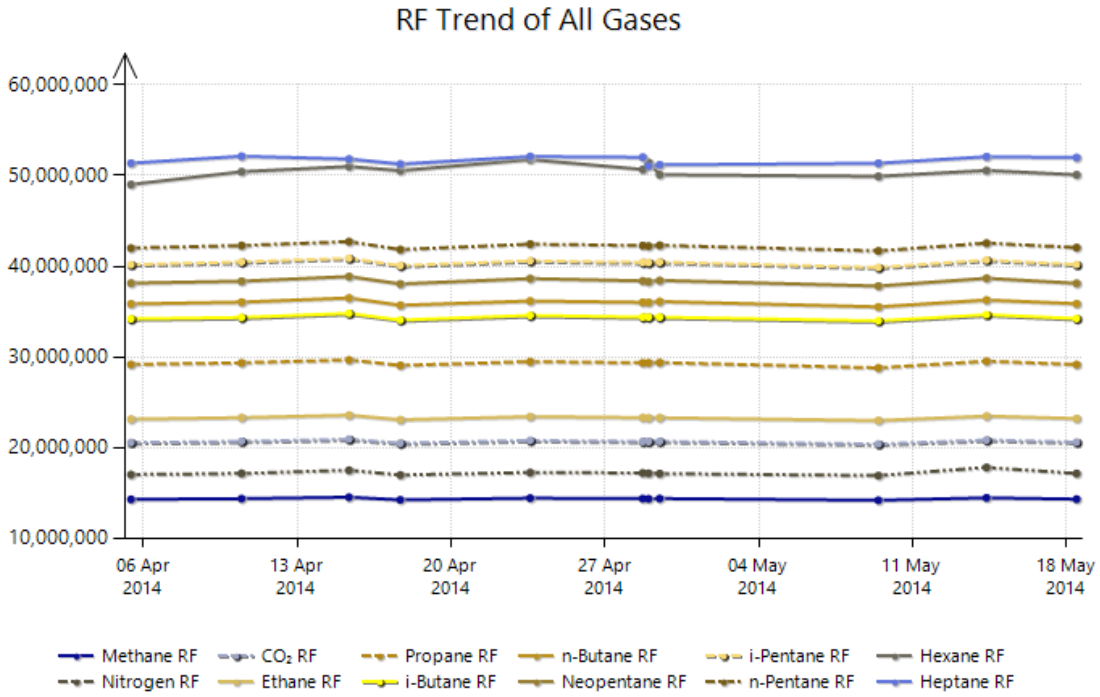
If you do not want the gridlines or chart legend to be included in the image file, right click on the chart and uncheck **Show Gridlines** or **Show Legend** or both.

10.8 Colourblind Assistance

To aid users with colour blindness (protanopia and deuteranopia), GCAS Desktop provides an alternative colour scheme for the chart. Use the **Colourblind assist** button on the options box.



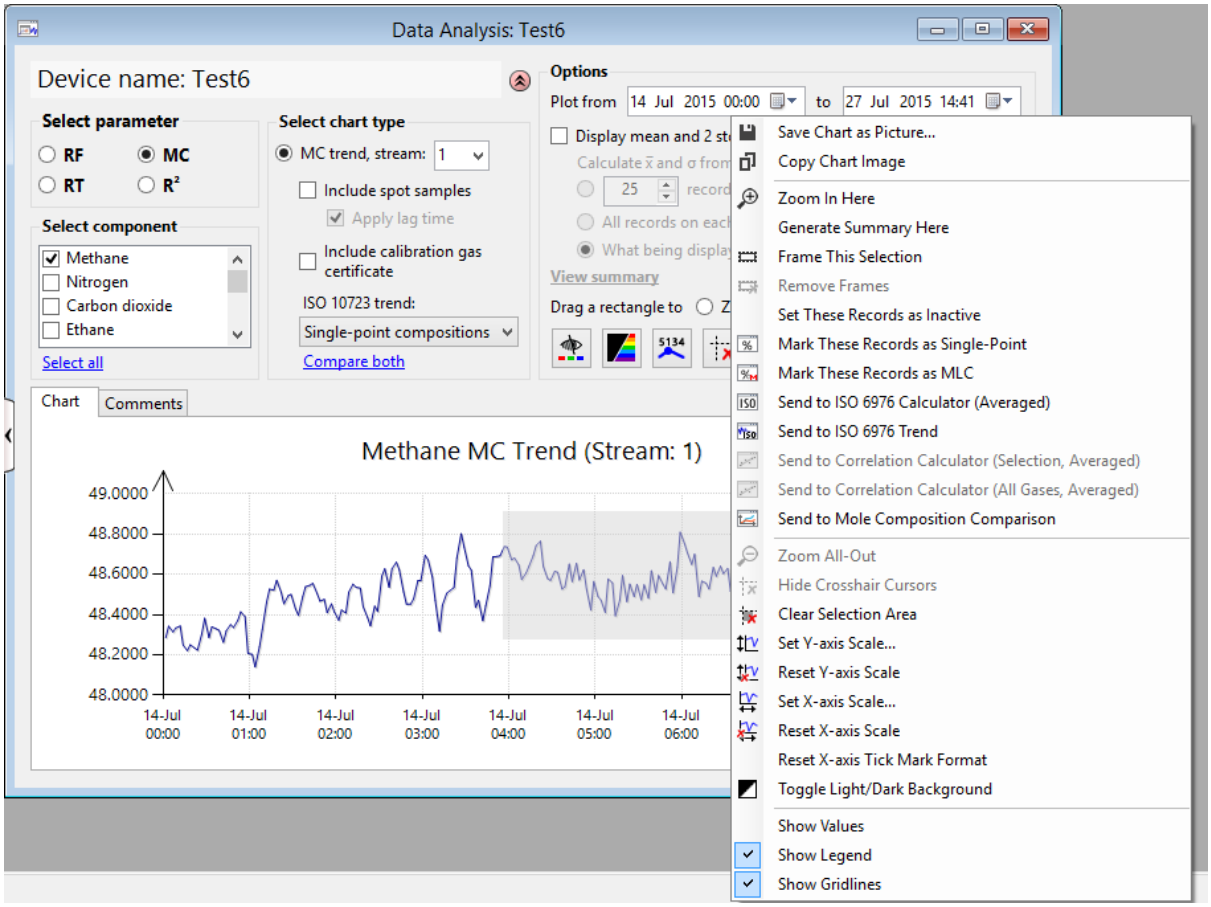
Normal colour scheme, colourblind assistance turned off.



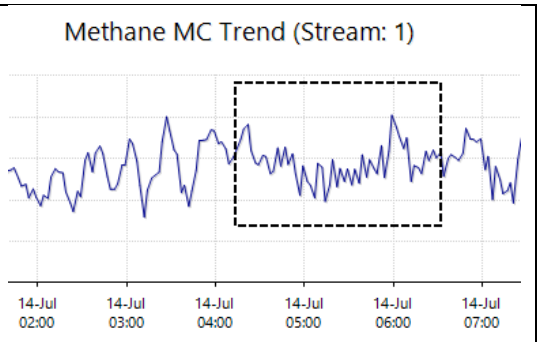
Alternative colour scheme, colourblind assistance turned on.
Similar colours are distinguished by dash or dotted style.

10.9 Selection Mode Menus

These menus are available if Data Analysis chart is in selection mode and there is a selection rectangle on the chart.



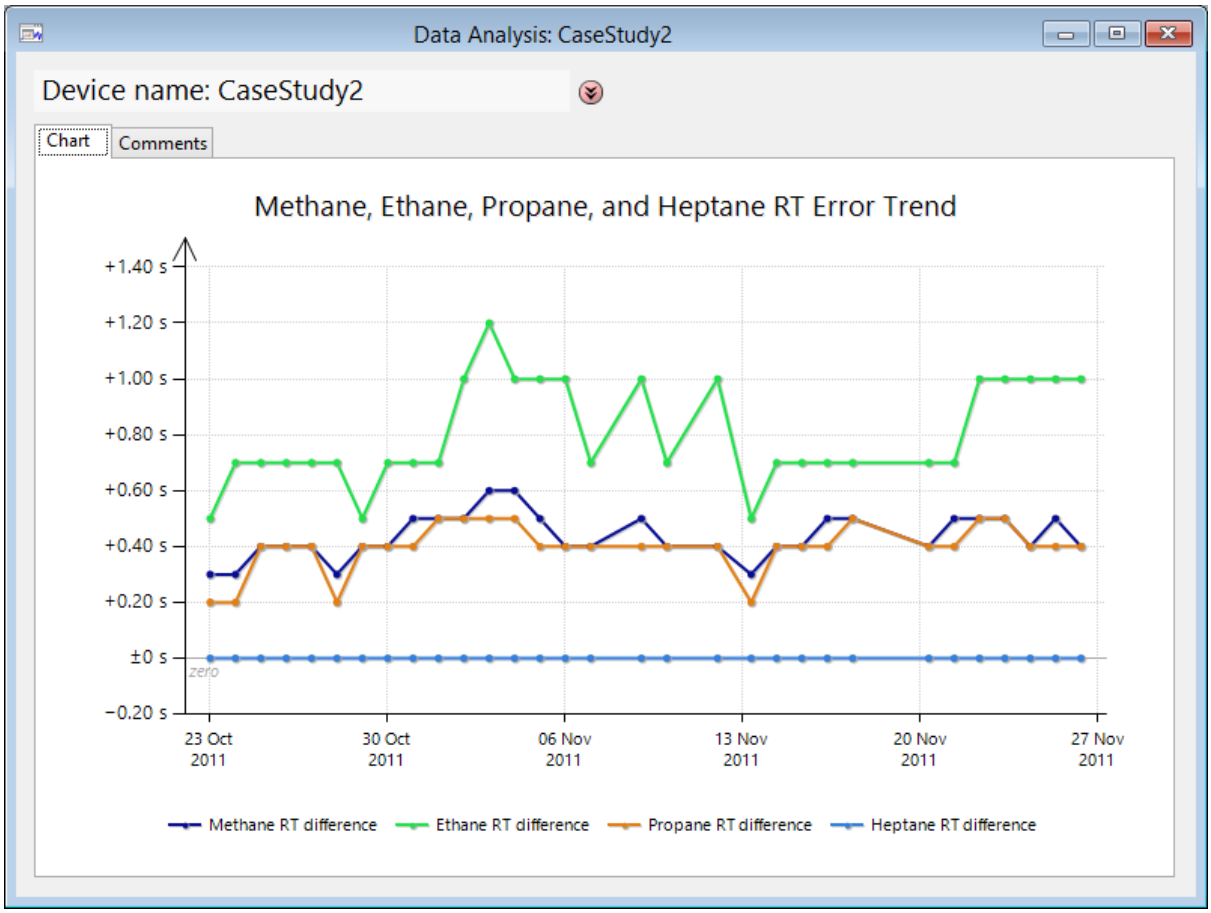
Menu	Which parameter?	Licence requirement	Function
Zoom In Here	Any	-	Zooms in to the selection area.
Generate Summary Here	Any	-	Generates statistical summary for the selected area (in contrast to **View summary** link which generates summary for the entire X-axis)
Frame This Selection	Any	-	Literally puts a rectangular frame around the selection, for presentation purpose.

			
Remove Frames	Any	-	Deletes all frames created through *Frame This Selection* menu.
Set These Records as Inactive	Any	-	Sets all records within the X-axis range of the selection area as inactive. If you are on R^2 trend chart, this sets the underlying footprint/calibration records as inactive.
Mark These Records as Single-Point	RF, MC	*ISO 10723*	Sets the MLC flag bit of all records within the X-axis range of the selection area as single-point RF or MC.
Mark These Records as MLC	RF, MC	*ISO 10723*	Sets the MLC flag bit of all records within the X-axis range of the selection area as multilevel-calibrated RF or MC.
Send to ISO 6976 Calculator (Averaged)	MC	*ISO 6976 Calculator*	Sends the averaged mole composition value of each gas of all records contained inside the selection area to ISO 6976 Calculator. The ISO 6976 output values may be different from the next menu (sending to ISO 6976 Trend and then activating the mean and standard deviation lines).
Send to ISO 6976 Trend	MC	*ISO 6976 Trend*	Loads ISO 6976 Trend form and instructs it to plot the ISO 6976 values for mole composition records contained inside the selection area.
Send to Correlation Calculator (Selection, Averaged)	RF trend; not RF *error* trend	-	Sends the averaged RF value of any gases that intersects with the selection area, to Correlation Calculator. For example, if your selection area contains methane and ethane line, only methane and ethane are sent to Correlation Calculator. Their RF values inside the selection area are averaged and then sent.
Send to Correlation Calculator (All Gases, Averaged)	RF trend; not RF *error* trend	-	Sends the averaged RF value of all gases of all records contained inside the selection area to Correlation Calculator.

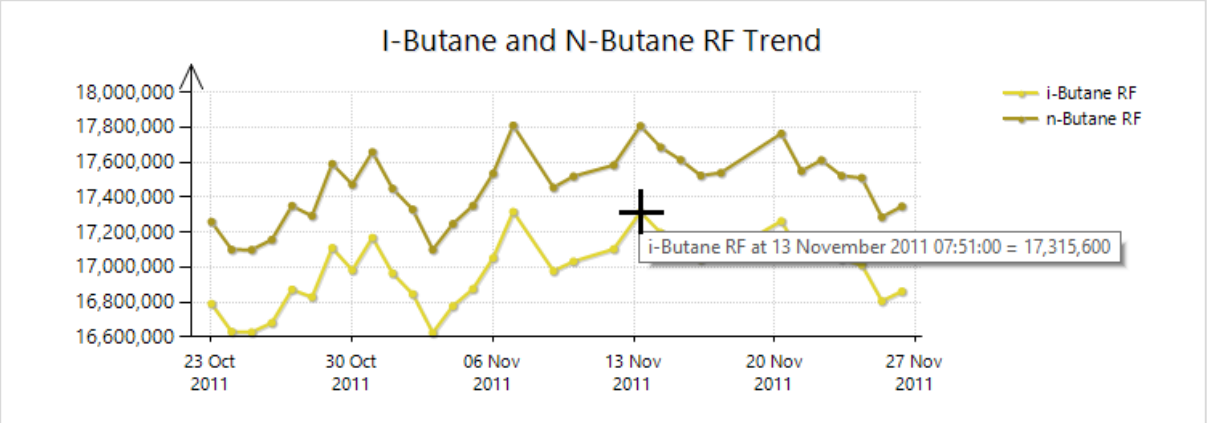
Send to Mole Composition Comparison	MC; requires only one gas selected	*ISO 10723* and *Data Comparison*	Sends mole composition values of the selected gas of all records contained inside the selection area to Mole Composition Comparison; then instructs the form to compare the single-point versus MLC composition of that gas.

10.10 Other Visual Cues

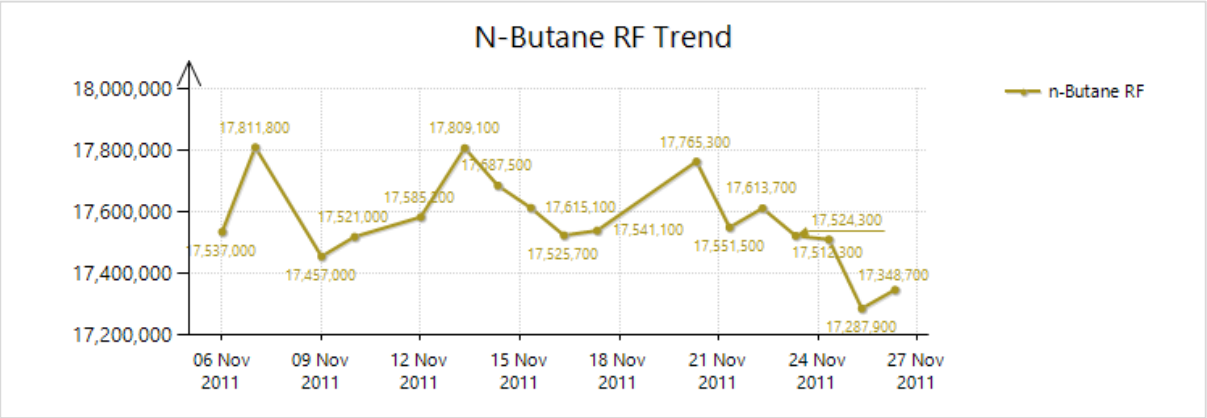
Enlarge chart area by hiding the parameters panel through the **Expand** button. To show the parameters panel again, click **Collapse**.



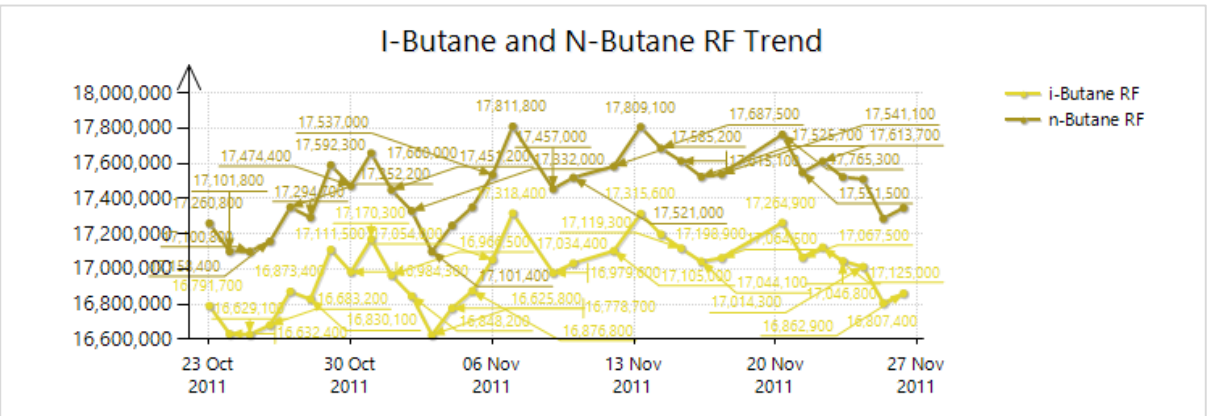
Hover your mouse cursor over a data point to see its value.



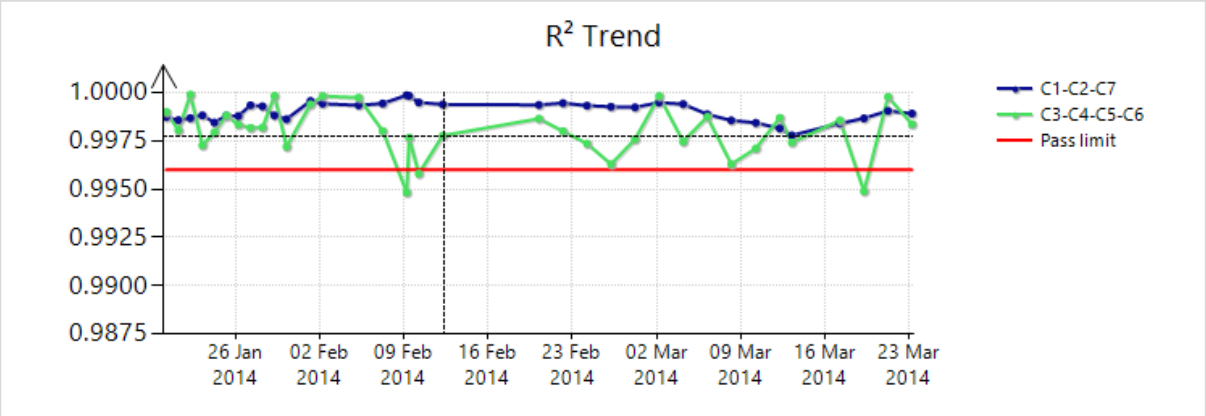
Alternatively, use the  **Show values** button (or right click on the chart and choose **Show Values**).



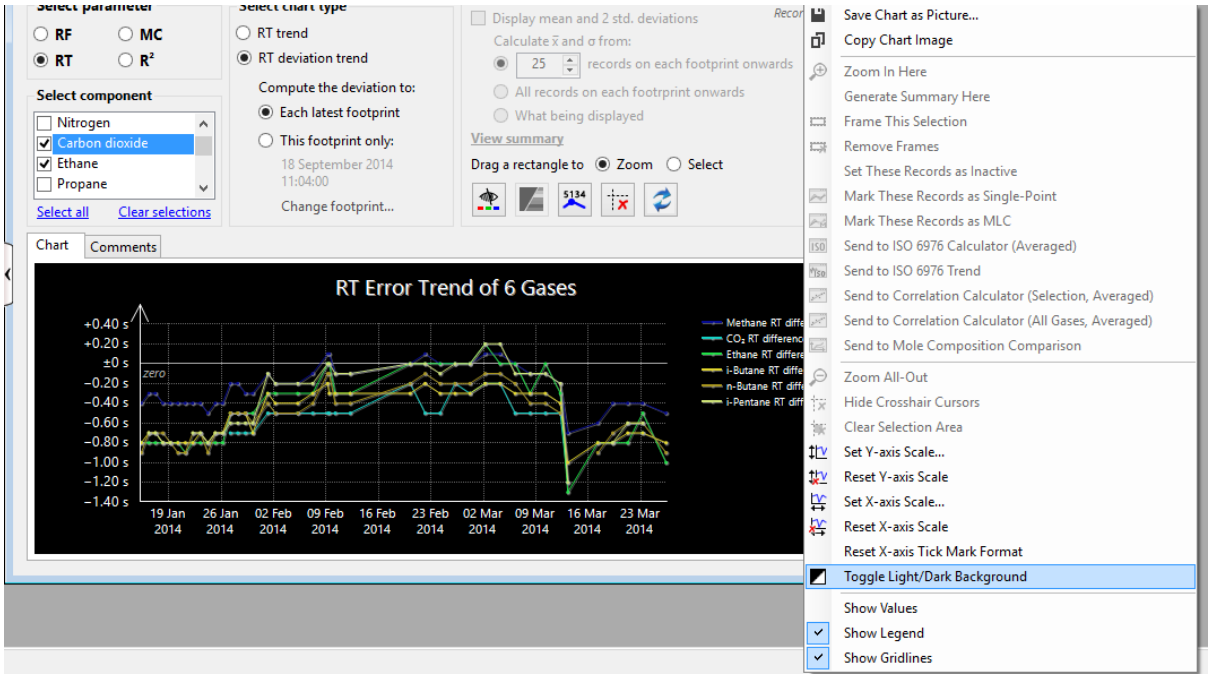
We don't recommend to show values on chart with many data points as the number labels may flood the chart area — unless you have zoomed it in.



Crosshair cursors are the dotted lines appearing on the chart when you left-click on it or as a remnant of zoom operation. These may act as a ruler or guide. To remove them, click **Hide crosshair cursor** button (or right-click on the chart then select **Hide Crosshair Cursors**).

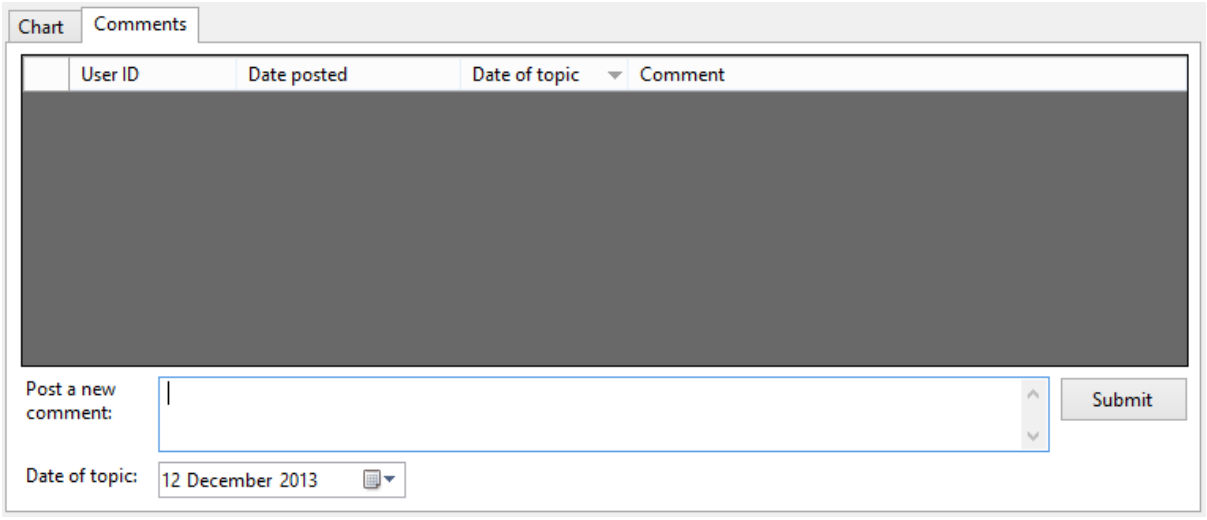


To use black background, right click on the chart and click **Toggle Light/Dark Background** menu. Use the same menu to revert back to white. The black background is permanent when you save the chart as image file or copy chart image to clipboard.



10.11 Insert Comment

To view or write comment, open the **Comments** tab.



Write your comment and set the appropriate date of topic, then click **Submit**. Your comment will have a yellow background to distinguish it from comments by other users. **Date of topic** is an additional information of which calibration data/footprint/mole composition record you are writing your comment for, thus other users know the correct data point to refer to.

Make sure that the comment is correct e.g. free from spelling errors, because once submitted you would not be able to remove your comment. This is a part of audit trail requirements.

The main **Refresh** button does also reload comments.

If you do not see the text box to write your comment, i.e. you only see the comment grid view, your GCAS user account doesn't have the action permission to write comment in Data Analysis. Contact your GCAS administrator.

11 Uncertainty Calculation

Uncertainty Calculation is a module to calculate the uncertainties of your GC device. This is related to condition-based maintenance which allows early detection of GC failures. Method to calculate GC uncertainties is described in the journal article
Sutan, A. and Daniel, P., "Gas Chromatography – Conditional Based Monitoring and Live Uncertainty Calculation", *North Sea Flow Measurement Workshop* (2012)
and
Sutan, A and Daniel, P., "Gas Chromatography Maintenance using Uncertainty-Based CBM", *The Americas Flow Measurement Conference* (2013).

Note

This module requires GCAS feature *Uncertainty Calculation* to be included in your GCAS licence.

Uncertainty calculation takes four input groups:

1. Uncertainty from the calibration gas — a calibration gas certificate is mandatory;
2. Uncertainty from GC repeatability and linearity,
3. Uncertainty from GC reproducibility,
4. ISO 6976:1995 inputs.

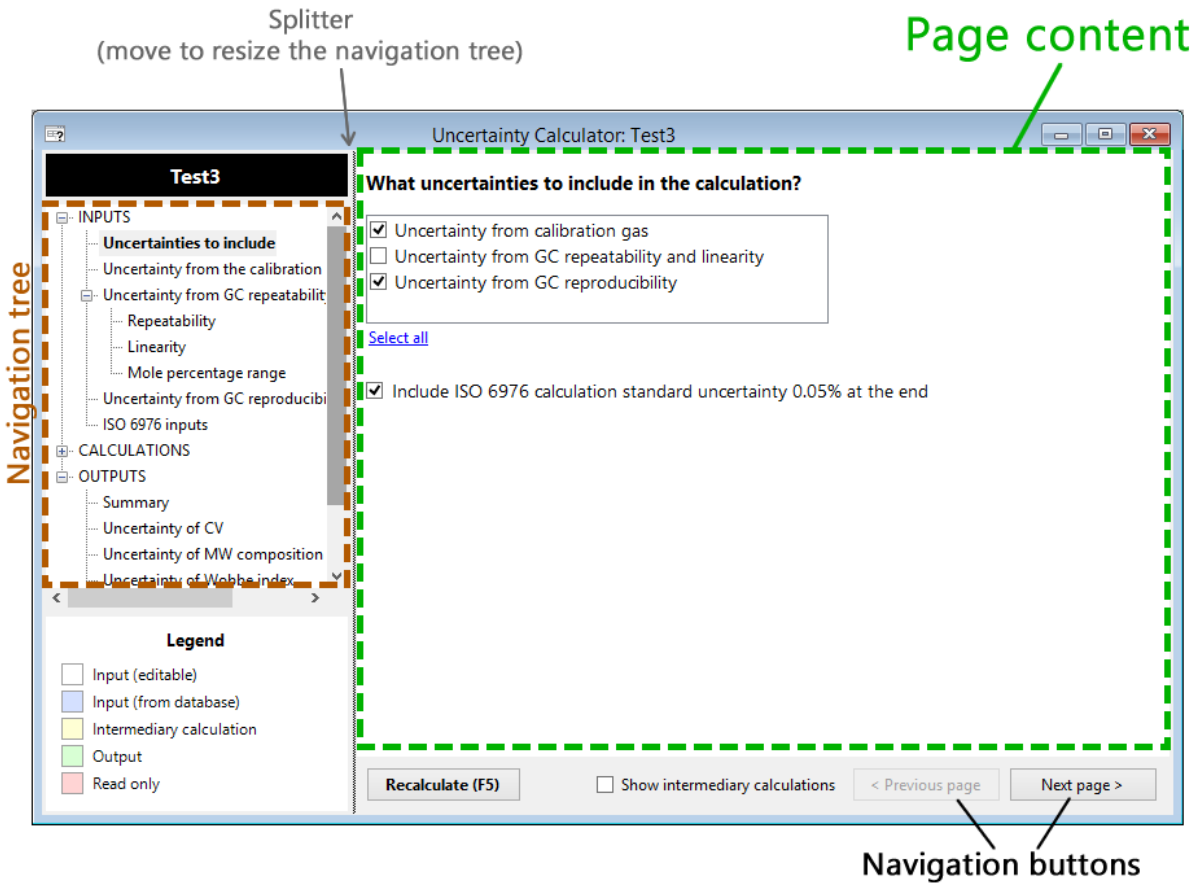
And it produces two output groups:

1. Uncertainties of ISO 6976:1995 outputs,
2. Uncertainties of GC for each gas component.

11.1 The *Uncertainty Calculator* Form

To calculate uncertainties of a particular GC device, select the device on your device panel or recent device panel. Then, go to the View menu > **Uncertainty Calculation**.

The form behaves like a wizard although it is not. It has a collection of *pages* categorised into three groups: inputs, calculation, and outputs. To navigate between pages, use the two buttons at the bottom-right corner **Next page** or **Previous page**; or you can also jump to the desired page straight away through the *navigation tree* on the left side.



Uncertainty Calculator form and its parts.

The form contains 23 pages as laid out in the navigation tree. Each terminal item links to its page within the form. Click on any item below to read more about its part.

- Inputs
  - Uncertainties to include
  - Uncertainty from the calibration gas
  - Uncertainty from GC repeatability and linearity
    - Repeatability
    - Linearity
    - Mole percentage range
  - Uncertainty from GC reproducibility
  - ISO 6976 inputs
- Calculations (normally collapsed)
  - Uncertainty of calibration gas
  - WRM RF and standard deviation
  - Uncertainty of repeatability
  - Footprint and calibration data
  - Uncertainty of reproducibility
  - Standard relative uncertainty
  - Compressibility factor
  - ISO 6976 calculation
  - Sensitivity analysis for $U_{calibration\ gas}$ and $U_{reproducibility}$

    - Sensitivity analysis for $U_{repeatability}$
- Outputs
    - Summary page
    - Uncertainty of CV (calorific value)
    - Uncertainty of MW composition
    - Uncertainty of Wobbe index
    - Uncertainty of relative density/specific gravity
    - Uncertainty of standard density

The navigation button **Next page** and **Previous page** change pages in sequential order. They may skip some pages depending on the selection you made on the previous page.

At anytime you leave input pages, Uncertainty Calculator form should perform all calculations. Once you are at intermediary calculation pages or output pages and you notice a mistake, you can always go back to the input pages either by clicking **Previous page** button successively until the form arrives at the desired page, or jump straight away using the navigation tree. After you make some changes in the inputs and go forward to later page, the form shall perform automatic recalculation thus new output values will update accordingly. If you notice the form does not recalculate, click **Recalculate** button or press F5 key on your keyboard to force a recalculation.

11.2 Calculation Steps

The form calculates your GC uncertainty is using the sequence below.

1. Calculate $U_{cal\ gas}$ if selected.
2. Calculate $U_{repeatability}$ if selected.
3. Calculate $U_{reproducibility}$ if selected.
4. Calculate U_{GC} at $k = 1$ which is the *standard relative uncertainty*. (k is coverage factor.)
5. Calculate Z_{mix} (compressibility factor of mixture) and Z_{air} based on the given base temperature and combustion temperature.
6. Perform all ISO 6976 calculations.
7. Perform sensitivity analysis on ISO 6976 outputs.
8. Calculate U_{CV}, U_{MW}, U_{Wobbe}, U_{SG}, and $U_{\rho s}$ — all uncertainties of ISO 6976 outputs.

11.3 Input Pages

Input pages collect all required information before the form performs a calculation. Visit subchapters below to get help about a specific page.

11.3.1 Uncertainties to Include

You can select which uncertainties to include in the calculation of *standard relative uncertainty* (U_{GC}).

$$U_{GC} = \sqrt{\left(U_{\text{cal gas}}\right)^2 + \left(U_{\text{repeatability}}\right)^2 + \left(U_{\text{reproducibility}}\right)^2}$$

For example, if you decide not to include uncertainty from the calibration gas, $U_{\text{cal gas}}$ is replaced by zero and the formula changes to

$$U_{GC} = \sqrt{\left(U_{\text{repeatability}}\right)^2 + \left(U_{\text{reproducibility}}\right)^2}$$

You must select at least one uncertainty component in order to proceed to the next page. If you don't, U_{GC} will be zero and all subsequent calculations afterwards will be meaningless.

Also in this page there is a check box to control whether to include ISO 6976 standard measurement uncertainty of 0.05% at the end of calculation. In the standard, ISO 6976 uncertainty is 0.1% at $k = 2$. Calculation of combined standard uncertainty uses $k = 1$, hence the ISO 6976 measurement uncertainty becomes 0.05%. Every result of ISO 6976 calculation shall carry this 0.05% uncertainty. By default this check box is ticked.

11.3.2 Uncertainty from the Calibration Gas

Select a calibration certificate in GCAS database. By default, GCAS Desktop loads the last installed certificate. This certificate is used later on when calculating $U_{\text{cal gas}}$, $U_{\text{reproducibility}}$, and ISO 6976 calculations.

You can see all installed calibration certificates through Calibration Gas Certificate form. That form also provides a way to submit a new certificate if the desired certificate has not been entered to the database.

11.3.3 Uncertainty from GC Repeatability and Linearity

To calculate $U_{\text{repeatability}}$, GCAS Desktop requires three sets of information: repeatability coefficients, response concentration coefficients, and mole percentage range.

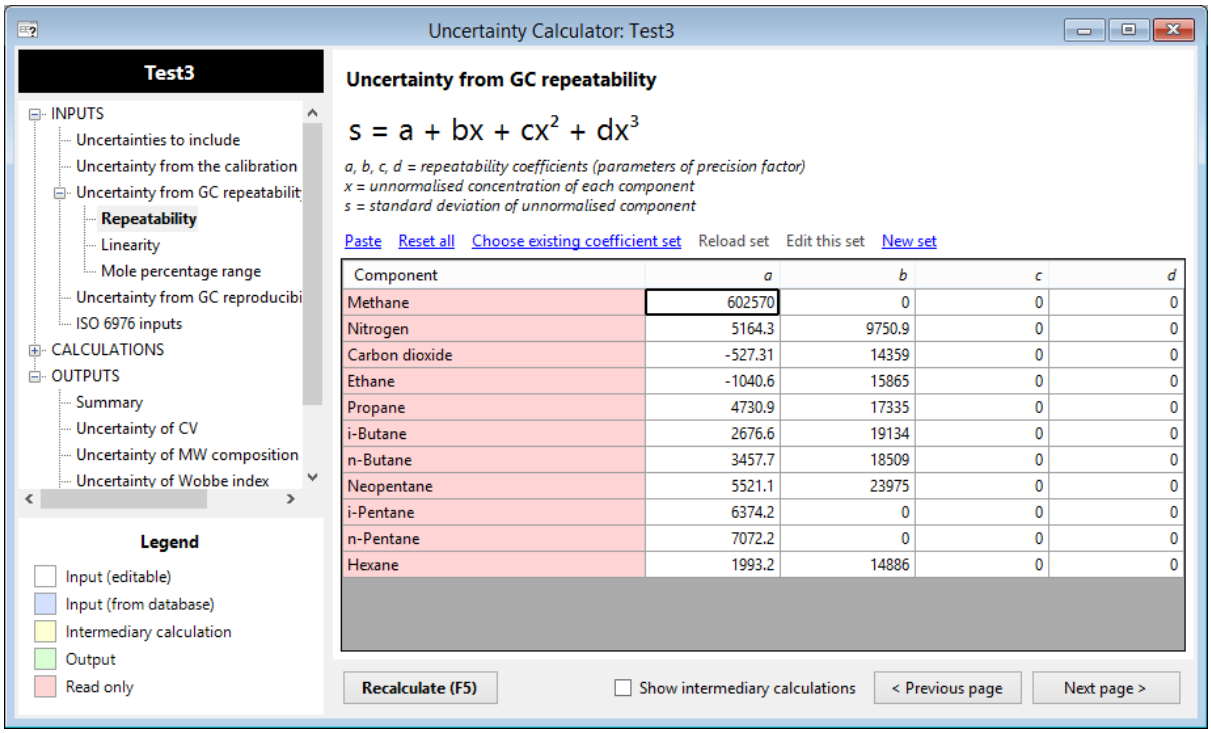
11.3.3.1 GC Repeatability

$$s_i = a + bx_i^* + cx_i^{*2} + dx_i^{*3}$$

In this formula, s_i is the standard deviation of unnormalised component i. The letter i is a simplification of enumeration from methane (e.g. from $i = 0$) to the highest carbon count. Four coefficients a, b, c, and d are called ***repeatability coefficients*** or *parameters of precision factors*. Detailed explanation of this formula is available on journal article Sutan, A. and Daniel, P., "Gas Chromatography – Conditional Based Monitoring and Live Uncertainty Calculation", *North Sea Flow Measurement Workshop* (2012).

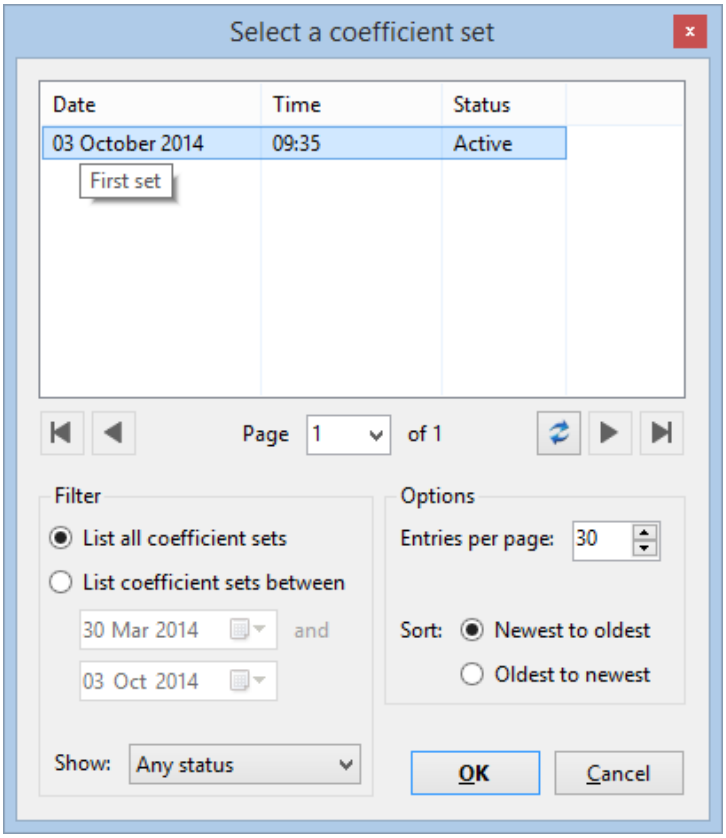
You need to enter these repeatability coefficients on the provided data grid. Double click the cell or press F2 to invoke edit mode. Alternatively, you can paste from Microsoft Excel or other spreadsheet

processing software as long as there are 4 (four) columns and equal number of rows. Click the **Paste** link above the grid to do so. The next link **Reset all** will reset all numbers back to zero.


Uncertainty Calculator: Test3
Test3
INPUTS
Uncertainties to include
Uncertainty from the calibration
Uncertainty from GC repeatabilit
Repeatability
Linearity
Mole percentage range
Uncertainty from GC reproducibi
ISO 6976 inputs
CALCULATIONS
OUTPUTS
Summary
Uncertainty of CV
Uncertainty of MW composition
Uncertainty of Wobbe index
Legend
Input (editable)
Input (from database)
Intermediary calculation
Output
Read only
Uncertainty from GC repeatability
s = a + bx + cx² + dx³
a, b, c, d = repeatability coefficients (parameters of precision factor)
x = unnormalised concentration of each component
s = standard deviation of unnormalised component
Paste Reset all Choose existing coefficient set Reload set Edit this set New set
Component a b c d
Methane 602570 0 0 0
Nitrogen 5164.3 9750.9 0 0
Carbon dioxide -527.31 14359 0 0
Ethane -1040.6 15865 0 0
Propane 4730.9 17335 0 0
i-Butane 2676.6 19134 0 0
n-Butane 3457.7 18509 0 0
Neopentane 5521.1 23975 0 0
i-Pentane 6374.2 0 0 0
n-Pentane 7072.2 0 0 0
Hexane 1993.2 14886 0 0
Recalculate (F5)
Show intermediary calculations
< Previous page
Next page >

Because these coefficients rarely change (about once a year), we suggest you to store these coefficients in database and recall them the next time you open Uncertainty Calculator form. To store a new coefficient set, click **New set**. This link opens a blank Uncertainty Coefficients form and you type (or paste) the coefficient numbers there. Visit chapter 12 to get detailed explanation of Uncertainty Coefficients form.

If GCAS Desktop detects there is at least one coefficient set in database, GCAS Desktop loads the latest coefficient set automatically for you. However if this is not the coefficient set you want, you can change which coefficient set in the database to load. Click **Choose existing coefficient set**, then GCAS Desktop displays the familiar *Select a coefficient set* dialogue.



Hover your mouse over the list item, on its date column, to reveal a tooltip about the description of the coefficient set. (Due to .NET Framework limitation, tooltip can only appear at the first column.) Click **OK** or double click the list item to load the coefficient set.

You can edit the coefficients after you load them from database too. Just go to the cell, double click or hit F2 to invoke edit mode, and enter the correct number. *However, this change is only temporary as it is only used in current session of uncertainty calculation*. If you need a permanent edit, you have to use Uncertainty Coefficients form then either create a new coefficient set or edit the existing one. Click **Edit this set** to open Uncertainty Coefficients form and invoke its edit mode. This link is only available if you haven't changed any numbers since the coefficient set is loaded from database. To undo all changes and revert back to the original coefficients from database, click **Reload set**.

11.3.3.2 GC Linearity

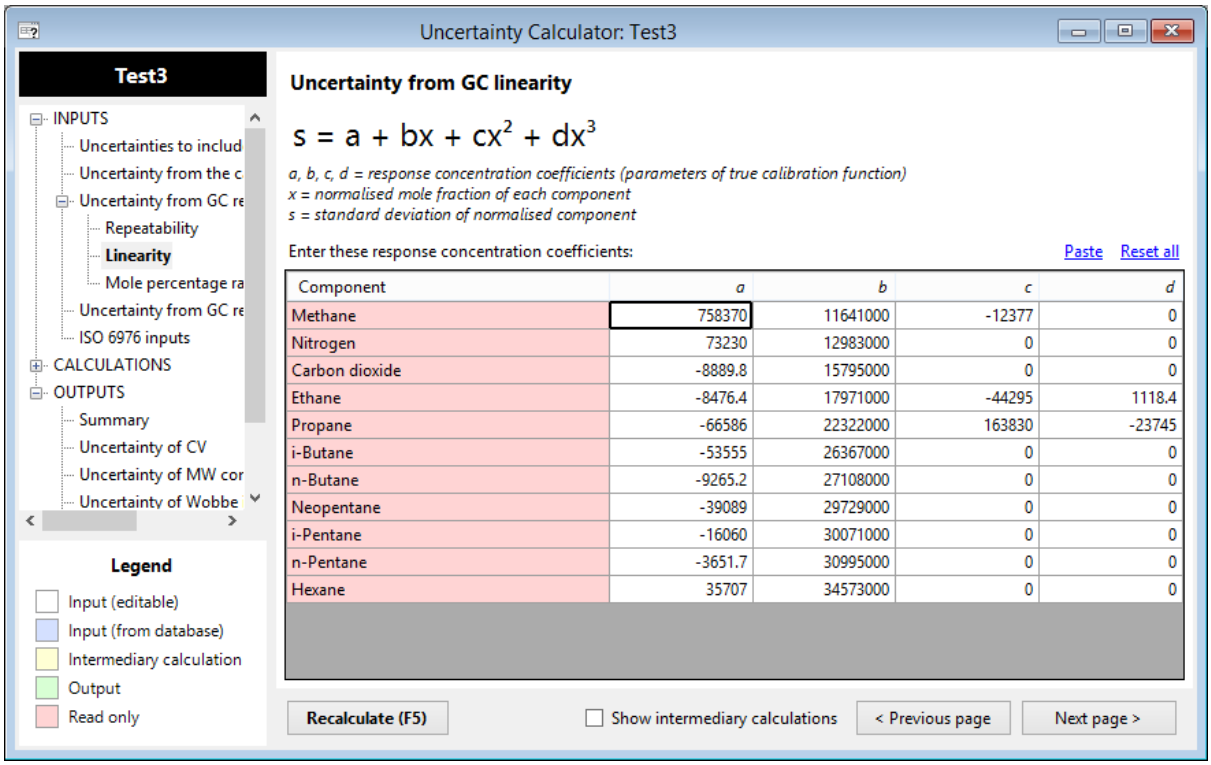
Formula displayed on this wizard page is very similar to GC repeatability:

$$s_i = a + bx_i^* + cx_i^{*2} + dx_i^{*3}$$

However the *s* here is different from the previous *s*. This formula is used to calculate the standard deviation of mixture gas and sample gas. The coefficients *a*, *b*, *c*, and *d* here are called ***response concentration coefficients*** or *parameters of true calibration functions*.

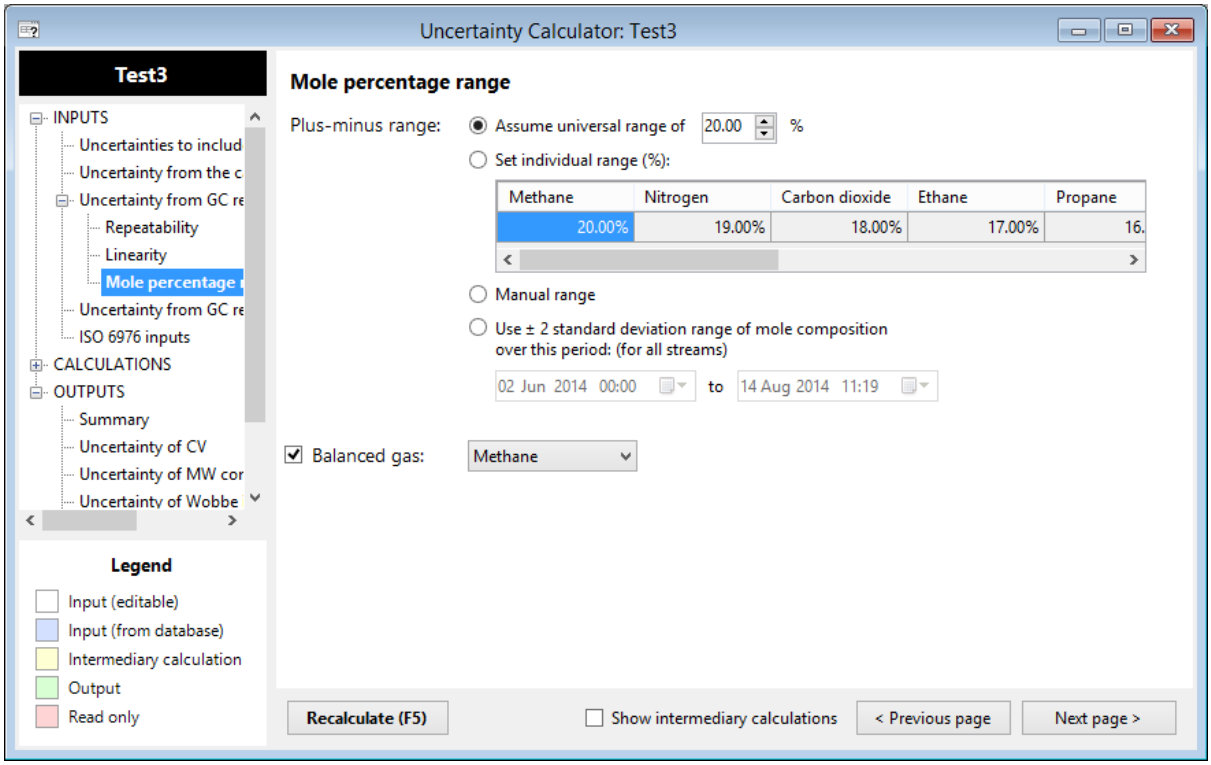
Similarly, you need to enter these response concentration coefficients on the provided data grid. Double click the cell or press F2 to enter edit mode. Alternatively, you can paste from Microsoft Excel

or other spreadsheet processing software as long as there are 4 (four) columns and equal number of rows.


Uncertainty Calculator: Test3
Test3
INPUTS
Uncertainties to includ
Uncertainty from the c
Uncertainty from GC re
Repeatability
Linearity
Mole percentage ra
Uncertainty from GC re
ISO 6976 inputs
CALCULATIONS
OUTPUTS
Summary
Uncertainty of CV
Uncertainty of MW cor
Uncertainty of Wobbe
Legend
Input (editable)
Input (from database)
Intermediary calculation
Output
Read only
Uncertainty from GC linearity
s = a + bx + cx² + dx³
a, b, c, d = response concentration coefficients (parameters of true calibration function)
x = normalised mole fraction of each component
s = standard deviation of normalised component
Enter these response concentration coefficients:
Paste
Reset all
Component | a | b | c | d
Methane | 758370 | 11641000 | -12377 | 0
Nitrogen | 73230 | 12983000 | 0 | 0
Carbon dioxide | -8889.8 | 15795000 | 0 | 0
Ethane | -8476.4 | 17971000 | -44295 | 1118.4
Propane | -66586 | 22322000 | 163830 | -23745
i-Butane | -53555 | 26367000 | 0 | 0
n-Butane | -9265.2 | 27108000 | 0 | 0
Neopentane | -39089 | 29729000 | 0 | 0
i-Pentane | -16060 | 30071000 | 0 | 0
n-Pentane | -3651.7 | 30995000 | 0 | 0
Hexane | 35707 | 34573000 | 0 | 0
Recalculate (F5)
Show intermediary calculations
< Previous page
Next page >

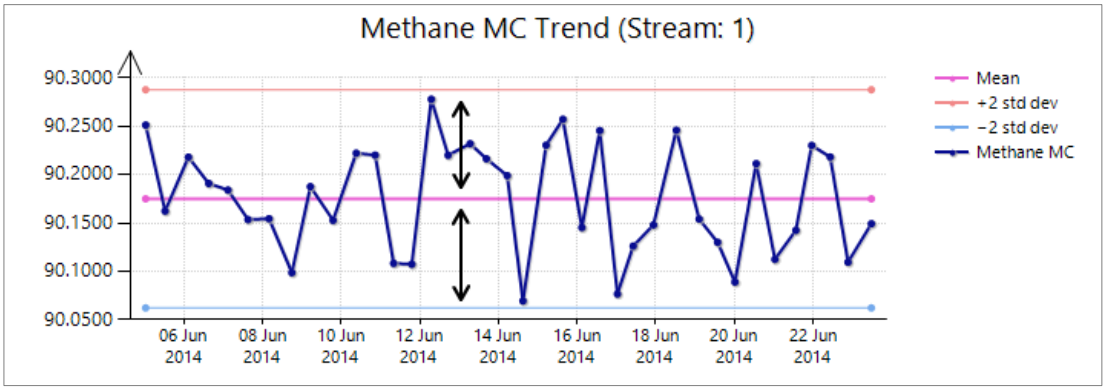
You can also load a coefficient set stored in database. If you already loaded a set for GC repeatability, it also loads for GC linearity. Go to page 146 to read more about loading a coefficient set from database.

11.3.3.3 Mole Percentage Range



Choose how the mole percentage plus-minus range be calculated. This plus-minus range will affect the final $U_{repeatability}$ value.

- **Assume universal range**: Every gas (component) uses the same range. This is the most inaccurate option but provides a fail-safe estimate if you do not have sufficient data in Mole Composition module.
- **Set individual range**: Each gas (component) has its own plus-minus range and is independent from one another. This option has better accuracy compared to the universal range.
- **Manual range**: You will type the minimum mole percentage and maximum mole percentage directly at WRM RF page later. Accuracy depends on these values. Use this option if you want to test some unexpected numbers.
- **Use ±2 standard deviation of mole composition**: The plus-minus range is taken from this standard deviation:



of mole composition records within the given period. This option provides the best accuracy.

Balanced gas option keeps your mole percentage low limit and high limit at 100%. This option is turned on by default and you can designate which one as the balanced gas. Typically, methane is the balanced gas because it is the largest component in the mixture and outnumbers other gases many times. To turn off this behaviour, untick **Balanced gas** check box.

Two tables below illustrate how the calculation will go if balanced gas option is turned off (top) and turned on (bottom). In this example, balanced gas is methane and a universal plus-minus range 15% is enforced.

Component	Mole percentages as in certificate	Mole percentages − 15%	Mole percentages + 15%
Methane	89.540070	76.1091	102.9711
Nitrogen	0.064110	0.0545	0.0737
CO_2	0.131230	0.1115	0.1509
Ethane	0.061000	0.0519	0.0702
Propane	0.055400	0.0471	0.0637
i-Butane	0.049180	0.0418	0.0566
n-Butane	0.056100	0.0477	0.0645
Neopentane	0.065100	0.0553	0.0749
i-Pentane	1.665080	1.4153	1.9148
n-Pentane	2.202900	1.8725	2.5333
Hexane	5.548780	4.7165	6.3811
Total	**99.43895**	**84.5232**	**114.3548**

Balanced gas option is turned off.

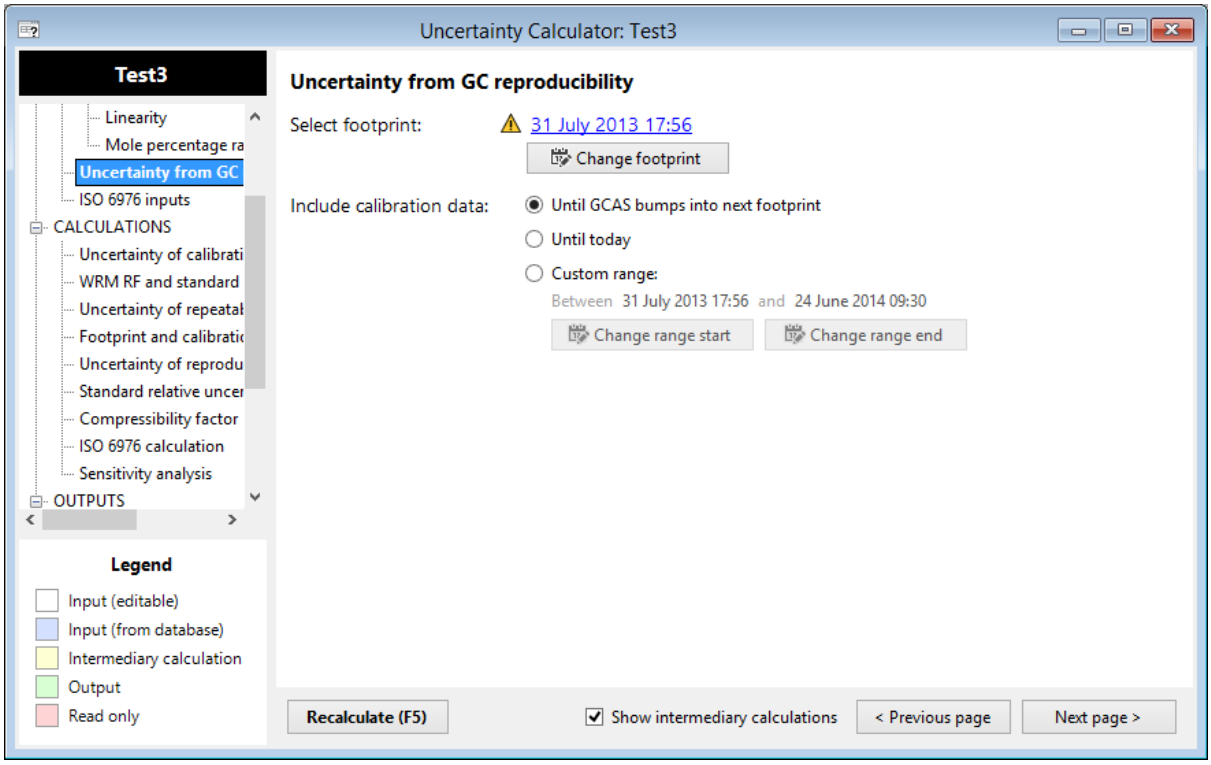
Component	Mole percentages as in certificate	Mole percentages − 15%	Mole percentages + 15%
Methane*	89.540070	91.5860	88.6163
Nitrogen	0.064110	0.0545	0.0737
CO_2	0.131230	0.1115	0.1509
Ethane	0.061000	0.0519	0.0702
Propane	0.055400	0.0470	0.0637
i-Butane	0.049180	0.0418	0.0566
n-Butane	0.056100	0.0477	0.0645
Neopentane	0.065100	0.0553	0.0749
i-Pentane	1.665080	1.4153	1.9148
n-Pentane	2.202900	1.8725	2.5333
Hexane	5.548780	4.7165	6.3811
Total	**99.43895**	**100.0000**	**100.0000**

Balanced gas option is turned on for methane. While other gases follow ±15% range, methane is calculated by 100 – sum of the others.

However if you choose another gas which has relatively small percentage as the balanced gas and it causes plus-minus range to fall onto negative number, GCAS Desktop replaces the negative

percentage with zero and thus their summation is not guaranteed to be 100%. Always choose the component with largest percentage as the balanced gas.

11.3.4 Uncertainty from GC Reproducibility



Select a footprint as a reference. You can see all footprints through Footprint form. If you choose a footprint that happens before the certificate installation date, GCAS Desktop displays a ⚠ warning icon.

Next, decide how many calibration data to include in the calculation. GCAS Desktop offers three choices:

- **Until GCAS bumps into next footprint**: The selected footprint itself and all calibration data up to one last calibration before next footprint are included in the calculation of $U_{reproducibility}$.
- **Until today**: The selected footprint itself and all calibration data *including subsequent footprints and all their calibration data afterwards*, all the way to this very moment (i.e. current computer time) are included in the calculation of $U_{reproducibility}$.
- **Custom range**: You can choose from which calibration record exactly to which calibration record that are included in the calculation of $U_{reproducibility}$. A ★ star indicates a footprint.

11.3.5 ISO 6976 Inputs

To be precise, ISO 6976 calculation requires four inputs:

1. Mole composition to use — here GCAS Desktop uses the selected calibration certificate as the mole composition,
2. Base pressure. The default is 1 atmosphere (101325 Pa) absolute,
3. Base temperature, and
4. Combustion temperature.

Many constants depends on the pair of combustion temperature and base temperature. The set of constants for 0°C is different from the set of constants for 15°C. In order to keep things simple, GCAS Desktop supports six pairs of combustion-base temperature:

- 0°C / 0°C
- 15°C / 0°C (combustion temperature = 15°C, base temperature = 0°C)
- 25°C / 0°C
- 15°C / 15°C
- 20°C / 20°C
- 25°C / 20°C

Split numbers are a set of numbers to indicate the composition of components higher than the device actually supports. For example, a C6+ device reads methane, ethane, propane, butane, pentane, and hexane (denoted "C6+"). The plus sign at "C6+" here indicates that higher C numbers such as C7 and C8 are merged into C6 because the device cannot read them. Split numbers are obtained through lab testing and are expressed using the format *n*/*n*[/*n*[/*n*]...] where *n* is a number. Sum of all numbers should be 100. For example, a C6+ device has split numbers on hexane as 60/30/10. This means mole percentage of hexane is actually 60% of the current hexane, heptane is 30% of hexane, and octane is 10% of hexane. Split numbers increase the accuracy of ISO 6976 outputs.

If you have these split numbers, enter them at the designated input text box. For C6+ devices you can enter up to 5 splits—which are the division among C6/C7/C8/C9/C10. C7+ devices accept maximum 4 splits, and C9+ devices accept maximum two splits. C10+ devices cannot accept split numbers because current version of GCAS Desktop supports up to C10 only.

The split numbers being entered should add up to 100. If they don't, GCAS Desktop will normalise them before redistributing the certificate mole percentage. For example, 50/30 normalises to 62.5/37.5 so their sum becomes 100.

If you don't have split numbers, leave it blank. GCAS Desktop will treat hexane or heptane or whatever the highest carbon count as a single entity throughout the calculation.

11.4 Calculation Pages

When you finished with ISO 6976 inputs, clicking **Next page** will take you directly to the output summary page and skipping the calculation pages. They were skipped because most users are only interested with the results. If you want to visit calculation pages, please check **Show intermediary calculations** before clicking **Next page**. Alternatively, expand the "CALCULATIONS" node at the navigation tree then pick an item to navigate.

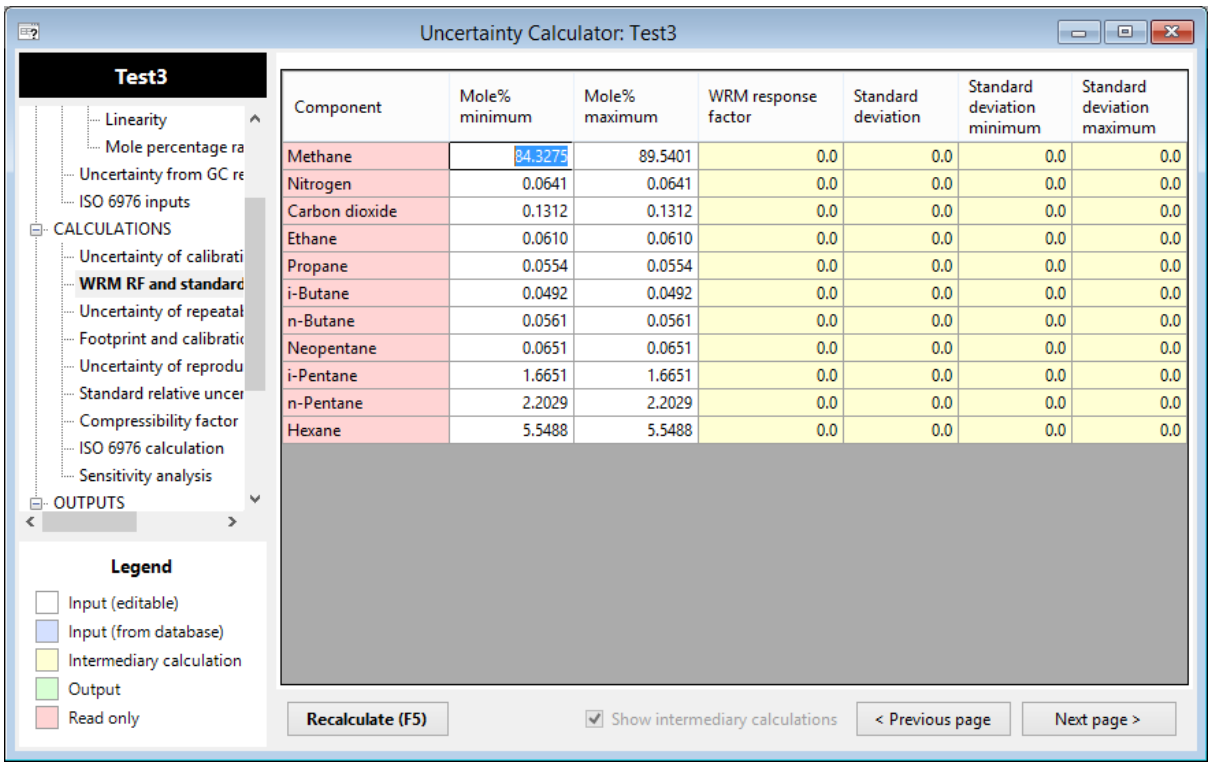
Calculation pages consist of ten pages:

1. **Uncertainty of calibration gas**
   This is the result of $U_{cal\ gas}$ calculation at $k = 2$.
   To obtain $U_{cal\ gas}$ at $k = 1$, divide these values by 2.
2. **WRM RF and standard deviation**
   This is the required calculation before we get $U_{repeatability}$. Here you see the mole percentage low limit and high limit according to the mole percentage range defined during input page. Also if you selected manual mole percentage range, you need to enter these low and high limit in this page. Head to chapter 11.4.1 to get help on that topic.
3. **Uncertainty of repeatability**
   This is the result of $U_{repeatability}$ calculation at $k = 1$.
4. **Footprint and calibration data**
   The form displays the response factor of the selected footprint and also average of all calibration data included in this calculation. To see where the average calculation of the calibration data came from, click on numbers that look like links. That will open another form to show the data feed. If you notice weird or unusual numbers at the average columns, open the detailed view to see if there are offending calibration records that should've been set as inactive.
5. **Uncertainty of reproducibility**
   This is the result of $U_{reproducibility}$ calculation at $k = 1$.
6. **Standard relative uncertainty**
   This is the result of U_{GC} at $k = 1$. To this point, we are half way finished with the calculation.
7. **Compressibility factor**
   It shows the calculation of Z_{mix} and Z_{air} based on the base pressure and temperature specified at ISO 6976 input page.
8. **ISO 6976 calculation**
   This page is probably worth visiting if you are interested with the calorific value, relative density, or some other output of ISO 6976 calculation.
9. **Sensitivity analysis (calibration gas & GC reproducibility)**
   This page displays the relative sensitivity of all ISO 6976 outputs for $U_{calibration\ gas}$ and $U_{reproducibility}$.
10. **Sensitivity analysis (GC repeatability)**
    This page displays the relative sensitivity of all ISO 6976 outputs for $U_{repeatability}$.

11.4.1 Manual Mole Percentage Range

If you selected manual mole percentage range for the calculation of $U_{repeatability}$, you need to enter mole percentage range on the WRM RF and standard deviation page. The column turns white to indicate that it is editable. Initial numbers on these columns are copied from your calibration gas certificate. Enter a lower value for mole percentage low limit and higher value for the high limit. On all options other than manual range, these columns appears yellow and is read-only.

Double click the cell or press F2 to enter edit mode. Type the minimum value or maximum value, then press Enter to commit. After you press Enter, you should see all columns on current row to the right side is recalculated. $U_{repeatability}$ is recalculated, thus U_{GC} and subsequent calculations also change.



Note

Manual mole percentage range is not balanced. The sum of low limit may be less than 100, and the sum of high limit can be more than 100.

11.4.2 Regarding Sensitivity Analysis

Starting from GCAS Desktop version 1.3.1.0, GCAS Desktop calculates two sensitivity sets. One for $U_{cal\ gas}$ and $U_{reproducibility}$, and the other for $U_{repeatability}$. Sensitivity of calibration gas and GC reproducibility is based on the mole percentages in your calibration certificate. Sensitivity of GC repeatability is based on the average between mole percentage lower bound and upper bound range.

If you chose *universal mole percentage range* or *individual mole percentage range* during that input page, the sensitivity of GC repeatability *becomes the same* as sensitivity of calibration gas and GC reproducibility. The reason is mole range for GC repeatability is also taken from the calibration certificate.

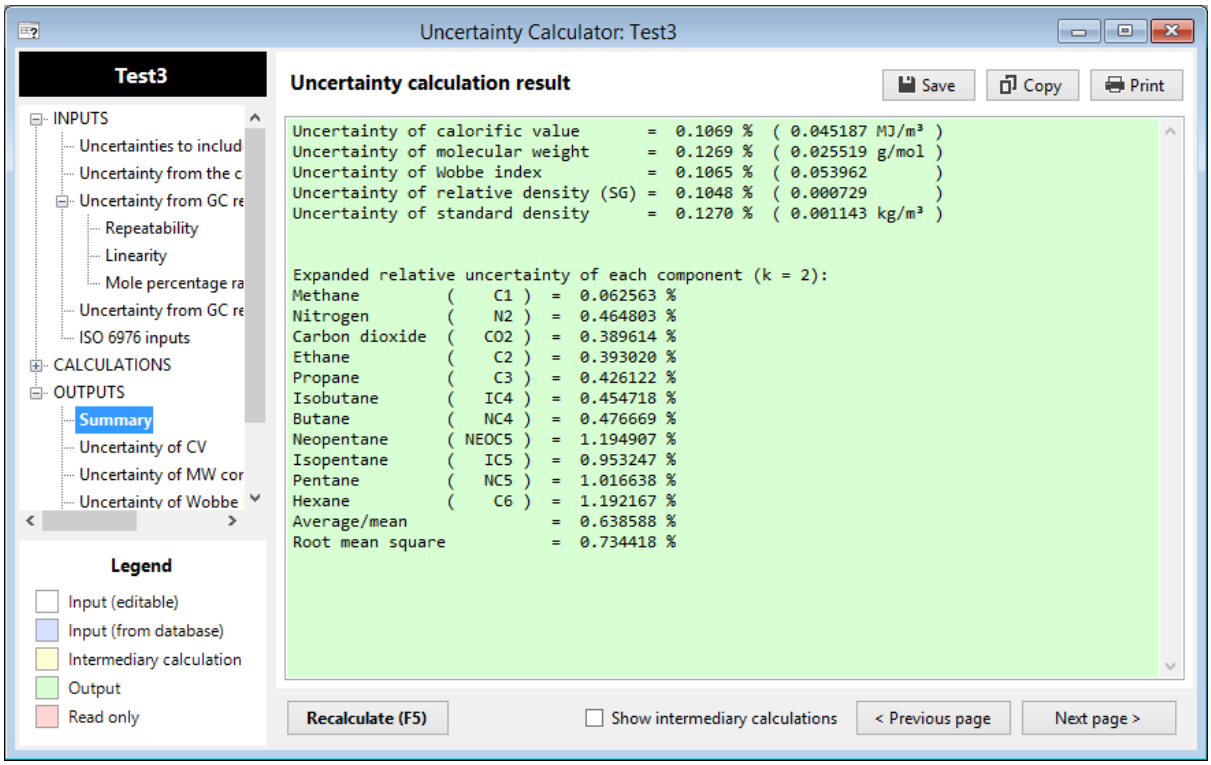
But if you selected *manual mole percentage range* or used ±2 standard deviations of mole composition records, the lower and upper bound of mole percentage range do not correspond to the calibration certificate anymore. Thus, GCAS Desktop calculates the correct sensitivity values and use these values for $U_{repeatability}$.

11.5 Output Pages

Output pages display calculation results. The primary interests here are uncertainties of ISO 6976 outputs. There is one summary page and five detailed pages, one detail page for every uncertainty result.

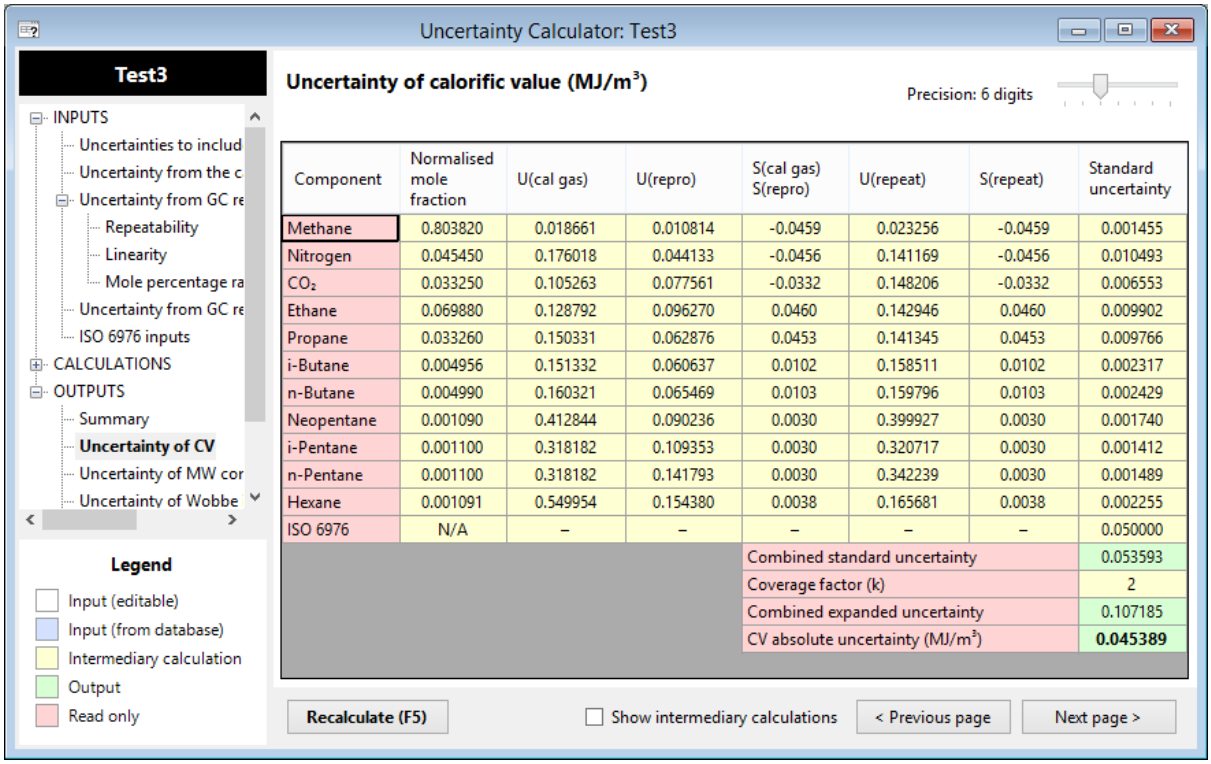
11.5.1 Summary Page

Summary page displays five uncertainties of ISO 6976 outputs and also *expanded relative uncertainty* (U_{GC} at k = 2). You can copy the report to clipboard, save it to a text file, or print it.


Uncertainty Calculator: Test3
Test3
INPUTS
Uncertainties to includ
Uncertainty from the c
Uncertainty from GC re
Repeatability
Linearity
Mole percentage ra
Uncertainty from GC re
ISO 6976 inputs
CALCULATIONS
OUTPUTS
Summary
Uncertainty of CV
Uncertainty of MW cor
Uncertainty of Wobbe
Legend
Input (editable)
Input (from database)
Intermediary calculation
Output
Read only
Uncertainty calculation result
Save
Copy
Print
Uncertainty of calorific value = 0.1069 % (0.045187 MJ/m³)
Uncertainty of molecular weight = 0.1269 % (0.025519 g/mol)
Uncertainty of Wobbe index = 0.1065 % (0.053962)
Uncertainty of relative density (SG) = 0.1048 % (0.000729)
Uncertainty of standard density = 0.1270 % (0.001143 kg/m³)
Expanded relative uncertainty of each component (k = 2):
Methane (C1) = 0.062563 %
Nitrogen (N2) = 0.464803 %
Carbon dioxide (CO2) = 0.389614 %
Ethane (C2) = 0.393020 %
Propane (C3) = 0.426122 %
Isobutane (IC4) = 0.454718 %
Butane (NC4) = 0.476669 %
Neopentane (NEOC5) = 1.194907 %
Isopentane (IC5) = 0.953247 %
Pentane (NC5) = 1.016638 %
Hexane (C6) = 1.192167 %
Average/mean = 0.638588 %
Root mean square = 0.734418 %
Recalculate (F5)
Show intermediary calculations
< Previous page
Next page >

11.5.2 Detailed Pages

There are five detail output pages, which are uncertainty for CV, uncertainty for MW composition, uncertainty for Wobbe index, uncertainty for relative density (specific gravity), and uncertainty of standard density. These pages share the same layout and same logic for five ISO 6976 outputs.


Uncertainty Calculator: Test3
Test3
INPUTS
Uncertainties to includ
Uncertainty from the c
Uncertainty from GC re
Repeatability
Linearity
Mole percentage ra
Uncertainty from GC re
ISO 6976 inputs
CALCULATIONS
OUTPUTS
Summary
Uncertainty of CV
Uncertainty of MW cor
Uncertainty of Wobbe
Legend
Input (editable)
Input (from database)
Intermediary calculation
Output
Read only
Uncertainty of calorific value (MJ/m³)
Precision: 6 digits
Component | Normalised mole fraction | U(cal gas) | U(repro) | S(cal gas) S(repro) | U(repeat) | S(repeat) | Standard uncertainty
Methane | 0.803820 | 0.018661 | 0.010814 | -0.0459 | 0.023256 | -0.0459 | 0.001455
Nitrogen | 0.045450 | 0.176018 | 0.044133 | -0.0456 | 0.141169 | -0.0456 | 0.010493
CO₂ | 0.033250 | 0.105263 | 0.077561 | -0.0332 | 0.148206 | -0.0332 | 0.006553
Ethane | 0.069880 | 0.128792 | 0.096270 | 0.0460 | 0.142946 | 0.0460 | 0.009902
Propane | 0.033260 | 0.150331 | 0.062876 | 0.0453 | 0.141345 | 0.0453 | 0.009766
i-Butane | 0.004956 | 0.151332 | 0.060637 | 0.0102 | 0.158511 | 0.0102 | 0.002317
n-Butane | 0.004990 | 0.160321 | 0.065469 | 0.0103 | 0.159796 | 0.0103 | 0.002429
Neopentane | 0.001090 | 0.412844 | 0.090236 | 0.0030 | 0.399927 | 0.0030 | 0.001740
i-Pentane | 0.001100 | 0.318182 | 0.109353 | 0.0030 | 0.320717 | 0.0030 | 0.001412
n-Pentane | 0.001100 | 0.318182 | 0.141793 | 0.0030 | 0.342239 | 0.0030 | 0.001489
Hexane | 0.001091 | 0.549954 | 0.154380 | 0.0038 | 0.165681 | 0.0038 | 0.002255
ISO 6976 | N/A | – | – | – | – | – | 0.050000
Combined standard uncertainty | 0.053593
Coverage factor (k) | 2
Combined expanded uncertainty | 0.107185
CV absolute uncertainty (MJ/m³) | 0.045389
Recalculate (F5)
Show intermediary calculations
< Previous page
Next page >

Column names starting with **U** are uncertainties. **U(repro)** for example, is the uncertainty of GC reproducibility at $k = 1$. Column names starting with **S** are sensitivities. As already explained in chapter 11.4.2, sensitivity for GC repeatability becomes identical to sensitivity of calibration gas and GC reproducibility if the mole percentage range is set to universal or individual mode.

What may be the interest here are the cells coloured in green. For example, let's use the screenshot above. The screenshot tells us uncertainty of calorific value, but the layout applies to other detail pages as well.

The cell at bottom-right corner rendered in bold font is the CV **absolute uncertainty**, or U_{CV}. It has a unit megajoules per cubic metres (MJ/m³). If you want to see how much the CV itself is, visit the ISO 6976 calculation page. Note that not all ISO 6976 outputs have units—look for the unit at the title label. Relative density and Wobbe index do not have unit.

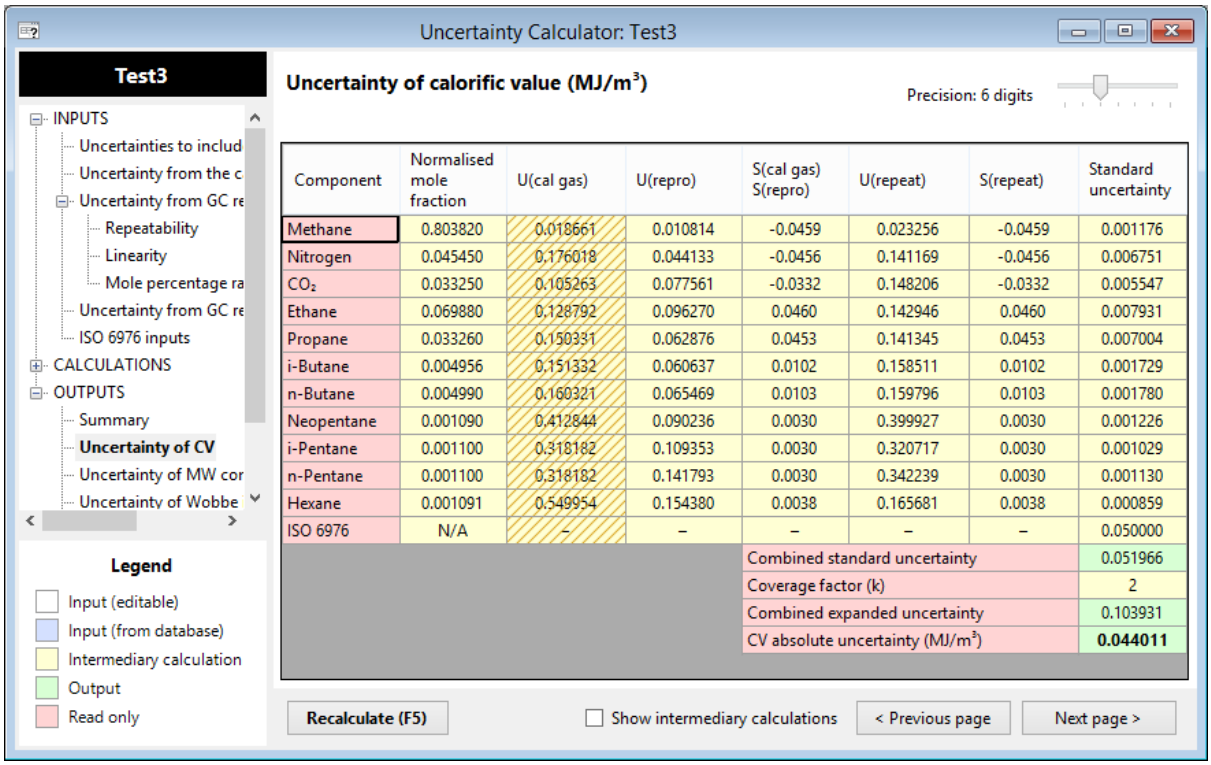
Above the absolute uncertainty is the **combined expanded uncertainty**. This is U_{CV} expressed in percentage, not in MJ/m³. The percentage is measured against the CV (again, in the ISO 6976 calculation page). Expanded uncertainty implies $k = 2$. And there is also **combined standard uncertainty** which indicates $k = 1$.

Standard uncertainty is calculated using this formula:

$$Standard\ uncertainty = \sqrt{\left(U_{cal\ gas} \times S_{cal\ gas}\right)^2 + \left(U_{repeatability} \times S_{repeatability}\right)^2 + \left(U_{reproducibility} \times S_{reproducibility}\right)^2}$$

where U and S are uncertainty and sensitivity respectively, given that all uncertainties are included. If you opt out the $U_{cal\ gas}$ for instance, the column **U(cal gas)** will be overlaid with a diagonal strokes

indicating the values are disregarded. $U_{cal\ gas}$ is treated as zero, so the formula above only contains $U_{repeatability}$ and $U_{reproducibility}$.


Uncertainty Calculator: Test3
Test3
INPUTS
Uncertainties to includ
Uncertainty from the c
Uncertainty from GC re
Repeatability
Linearity
Mole percentage ra
Uncertainty from GC re
ISO 6976 inputs
CALCULATIONS
OUTPUTS
Summary
Uncertainty of CV
Uncertainty of MW cor
Uncertainty of Wobbe
Legend
Input (editable)
Input (from database)
Intermediary calculation
Output
Read only
Uncertainty of calorific value (MJ/m³)
Precision: 6 digits
Component | Normalised mole fraction | U(cal gas) | U(repro) | S(cal gas) S(repro) | U(repeat) | S(repeat) | Standard uncertainty
Methane | 0.803820 | 0.018661 | 0.010814 | -0.0459 | 0.023256 | -0.0459 | 0.001176
Nitrogen | 0.045450 | 0.176018 | 0.044133 | -0.0456 | 0.141169 | -0.0456 | 0.006751
CO₂ | 0.033250 | 0.105263 | 0.077561 | -0.0332 | 0.148206 | -0.0332 | 0.005547
Ethane | 0.069880 | 0.128792 | 0.096270 | 0.0460 | 0.142946 | 0.0460 | 0.007931
Propane | 0.033260 | 0.150331 | 0.062876 | 0.0453 | 0.141345 | 0.0453 | 0.007004
i-Butane | 0.004956 | 0.151332 | 0.060637 | 0.0102 | 0.158511 | 0.0102 | 0.001729
n-Butane | 0.004990 | 0.160321 | 0.065469 | 0.0103 | 0.159796 | 0.0103 | 0.001780
Neopentane | 0.001090 | 0.412844 | 0.090236 | 0.0030 | 0.399927 | 0.0030 | 0.001226
i-Pentane | 0.001100 | 0.318182 | 0.109353 | 0.0030 | 0.320717 | 0.0030 | 0.001029
n-Pentane | 0.001100 | 0.318182 | 0.141793 | 0.0030 | 0.342239 | 0.0030 | 0.001130
Hexane | 0.001091 | 0.549954 | 0.154380 | 0.0038 | 0.165681 | 0.0038 | 0.000859
ISO 6976 | N/A | – | – | – | – | – | 0.050000
Combined standard uncertainty | 0.051966
Coverage factor (k) | 2
Combined expanded uncertainty | 0.103931
CV absolute uncertainty (MJ/m³) | 0.044011
Recalculate (F5)
Show intermediary calculations
< Previous page
Next page >

The Uncertainty Calculator form when $U_{cal\ gas}$ is excluded. Notice the CV absolute uncertainty is different from the previous screenshot (0.044011 versus 0.045389 MJ/m³).

There is a precision control at the top right region of these pages. This slider/trackbar controls how many decimal digits to display on the grid. By default, GCAS Desktop displays six digits after the decimal point.

12 Uncertainty Coefficients

Uncertainty Coefficients (capitalised C) is a tool to store uncertainty coefficients (repeatability coefficients and response concentration coefficients) in GCAS database so that you don't have to re-enter the same set of coefficients over and over again as they rarely change.

Note

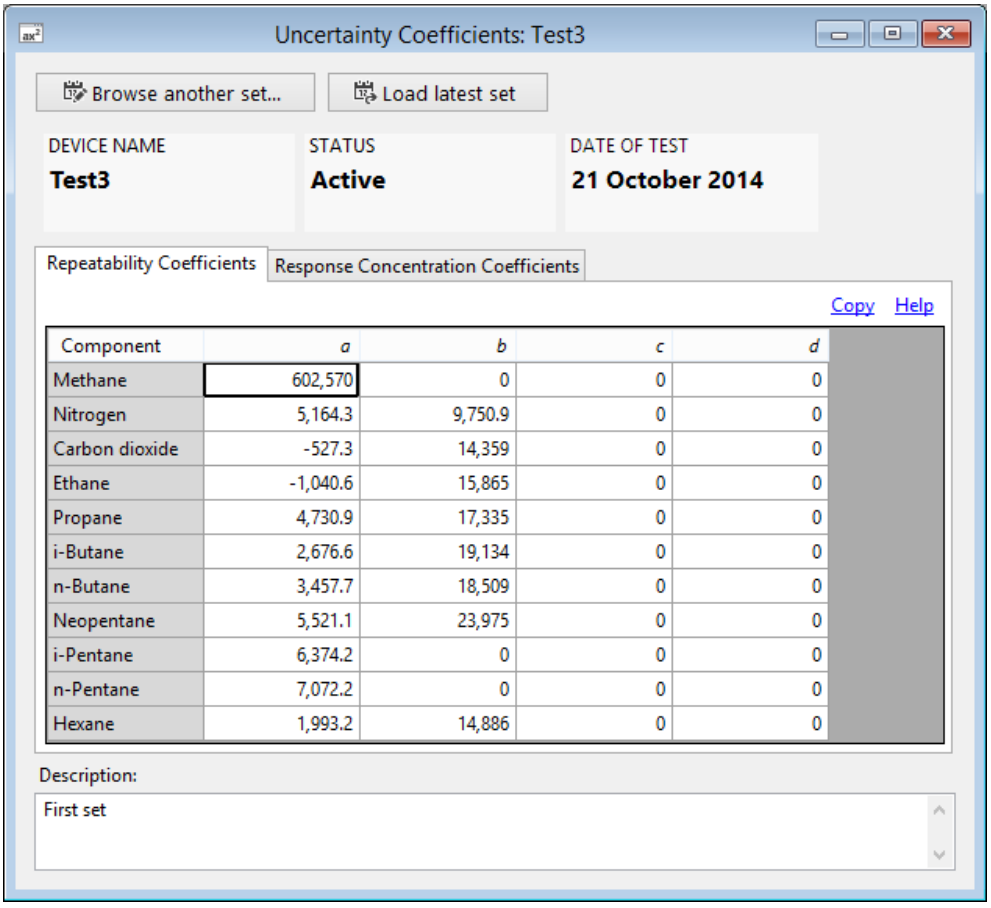
This module requires GCAS feature either *Uncertainty Calculation* or *Uncertainty Trend* to be included in your licence.

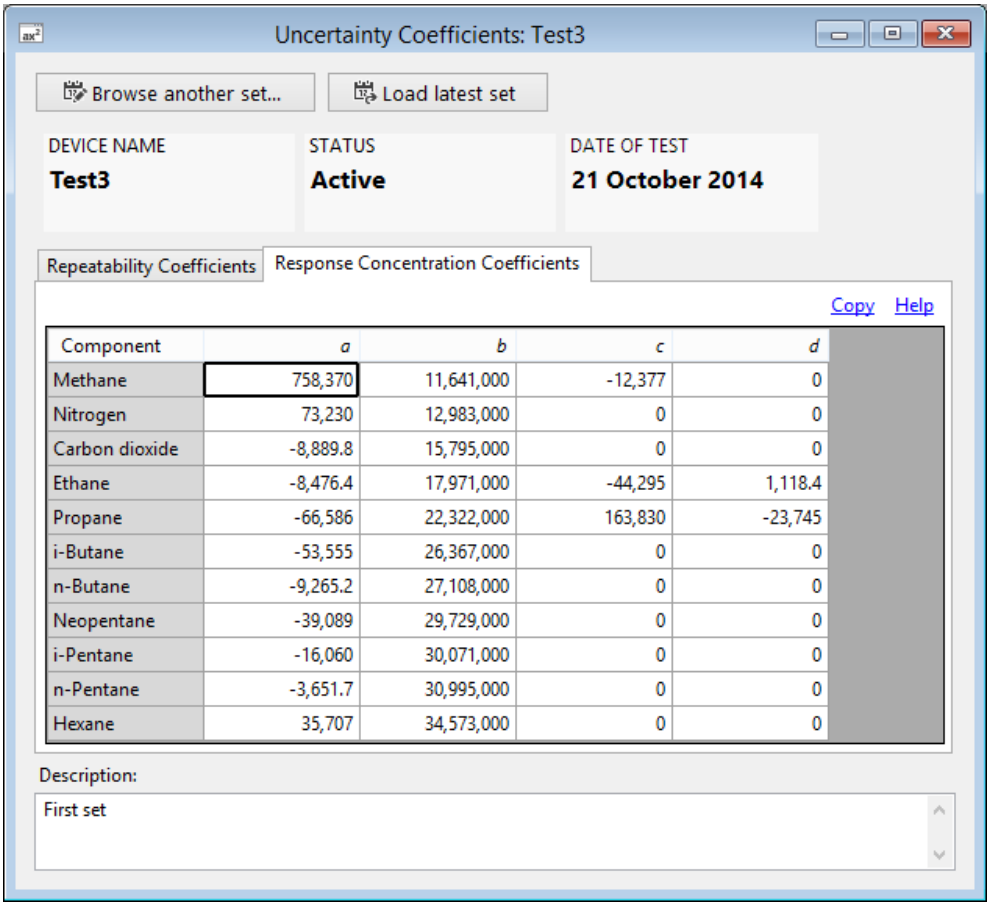
As seen at chapter 11.3.3, the coefficient input page on Uncertainty Calculator form has several links related to Uncertainty Coefficients. This chapter explains about Uncertainty Coefficients form which is the place to enter the uncertainty coefficient set.

The term *coefficient set* refers to collection of uncertainty coefficients (*a*, *b*, *c*, *d*), two packages of them (repeatability and response concentration), of all gases. Every gas has their own coefficients and these coefficients are bundled together into one *coefficient set* record in GCAS database.

12.1 The *Uncertainty Coefficients* Form

Uncertainty Coefficients form is accessible from the View menu > **Uncertainty Coefficients**. But before that, you need to select the correct GC device from the device panel or recent device panel.


Uncertainty Coefficients: Test3
Browse another set...
Load latest set
DEVICE NAME
Test3
STATUS
Active
DATE OF TEST
21 October 2014
Repeatability Coefficients
Response Concentration Coefficients
Copy
Help
Component a b c d
Methane 602,570 0 0 0
Nitrogen 5,164.3 9,750.9 0 0
Carbon dioxide -527.3 14,359 0 0
Ethane -1,040.6 15,865 0 0
Propane 4,730.9 17,335 0 0
i-Butane 2,676.6 19,134 0 0
n-Butane 3,457.7 18,509 0 0
Neopentane 5,521.1 23,975 0 0
i-Pentane 6,374.2 0 0 0
n-Pentane 7,072.2 0 0 0
Hexane 1,993.2 14,886 0 0
Description:
First set


Uncertainty Coefficients: Test3
Browse another set...
Load latest set
DEVICE NAME
Test3
STATUS
Active
DATE OF TEST
21 October 2014
Repeatability Coefficients
Response Concentration Coefficients
Copy
Help
Component a b c d
Methane 758,370 11,641,000 -12,377 0
Nitrogen 73,230 12,983,000 0 0
Carbon dioxide -8,889.8 15,795,000 0 0
Ethane -8,476.4 17,971,000 -44,295 1,118.4
Propane -66,586 22,322,000 163,830 -23,745
i-Butane -53,555 26,367,000 0 0
n-Butane -9,265.2 27,108,000 0 0
Neopentane -39,089 29,729,000 0 0
i-Pentane -16,060 30,071,000 0 0
n-Pentane -3,651.7 30,995,000 0 0
Hexane 35,707 34,573,000 0 0
Description:
First set

Uncertainty Coefficients form has two tabs, one for repeatability coefficients and the other for response concentration coefficients. Repeatability coefficients are used to calculate standard deviation of GC repeatability, and response concentration coefficients are used to calculate standard deviation of GC linearity. At the bottom there is a text box to display additional note or description about the coefficient set.

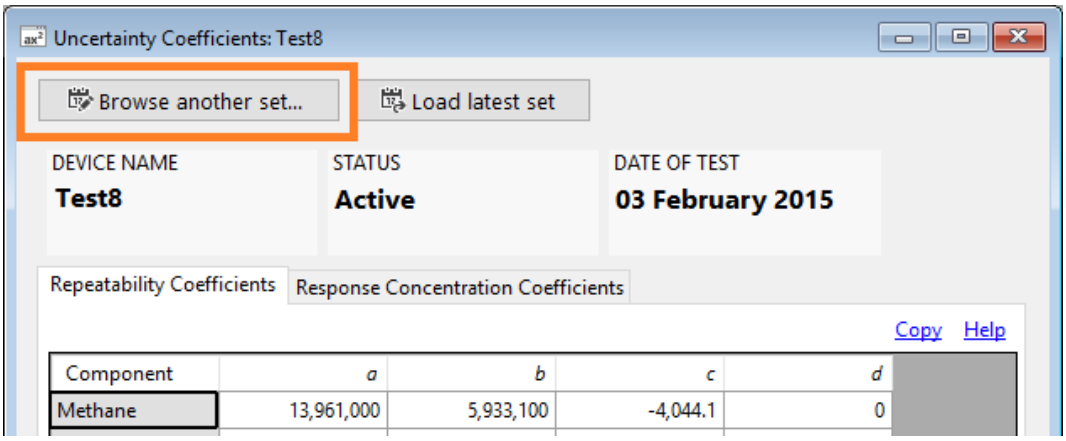
Each coefficient set consists of four coefficients, namely *a*, *b*, *c*, and *d* on both repeatability and response concentration. These are the coefficients of this formula:

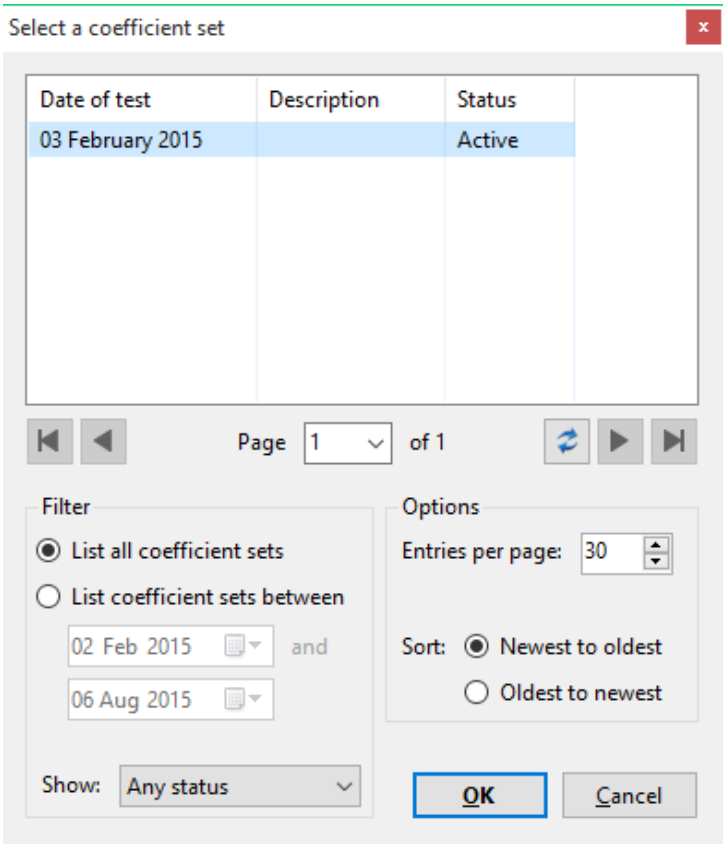
$$s_i = a + bx_i^* + cx_i^{*2} + dx_i^{*3}$$

Where *s* is the standard deviation of one gas/component used in the part of calculation, and x_i is mole fraction of this component.

12.2 View Previous Coefficient Sets

To view other uncertainty coefficient sets, click **Browse another set**. Select a different coefficient set, then click **OK** or double click the list item.



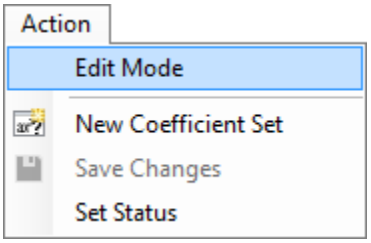


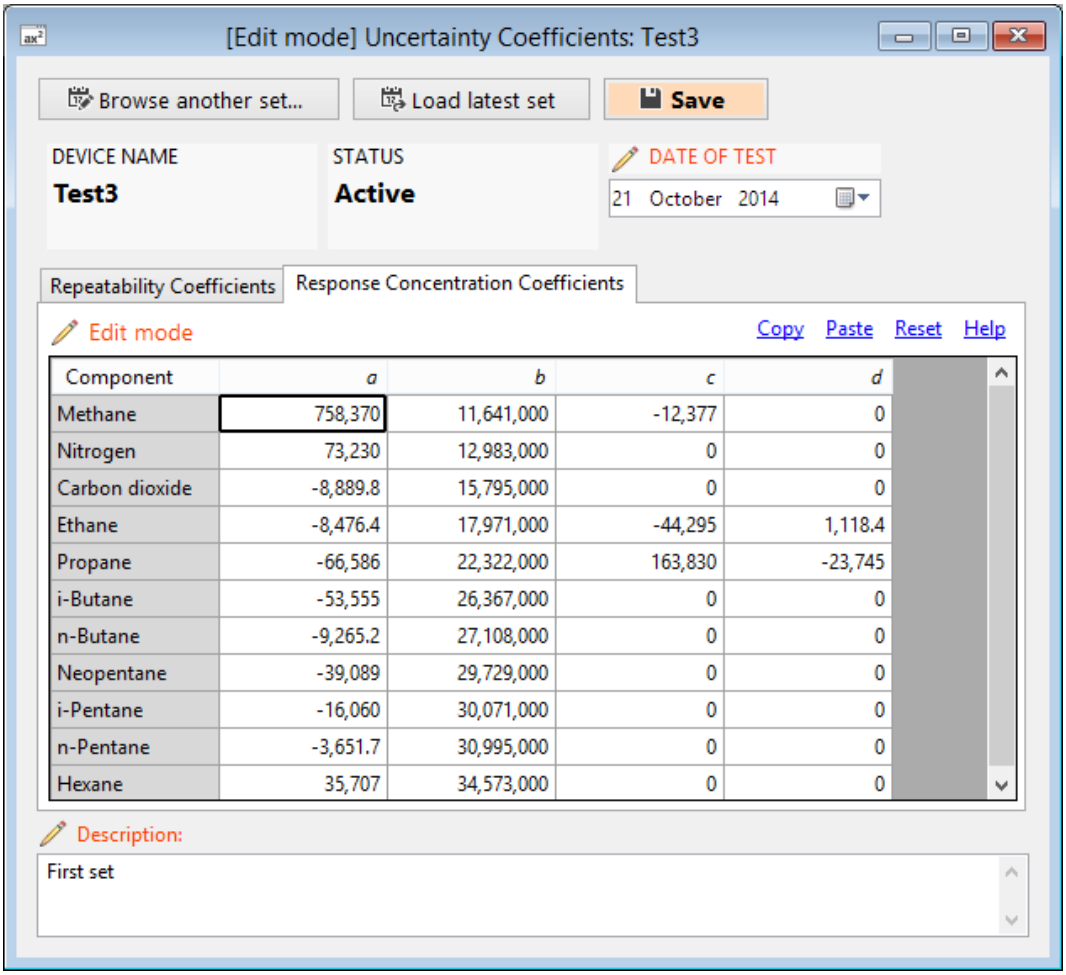
"Select a coefficient set" dialogue (Windows 10 doesn't render form border)

Click **Load latest set** to return to the most up-to-date uncertainty coefficient set.

12.3 Edit Mode

In order to edit the coefficients or the description, you need to put Uncertainty Coefficients form in *edit mode*. Open the Action menu and select **Edit Mode**. You know the form is on edit mode when you see pencil icon, some labels are coloured orange, and there is a **Save** button at the top region of the form.





The Uncertainty Coefficients form in edit mode.

During edit mode, you can edit the numbers in both grids (repeatability coefficient grid and response concentration coefficient grid). **Date of test** field at the top and **Description** text box at the bottom of the form also become editable.

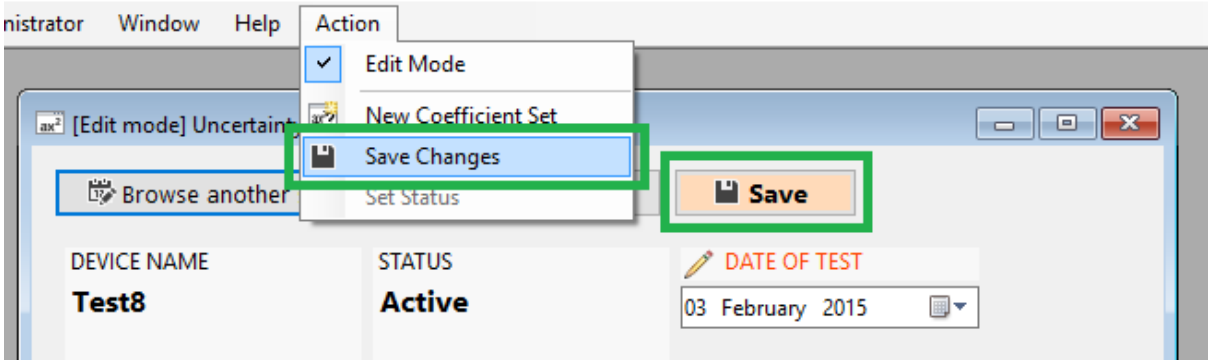
Note

Edit mode is mainly intended for editing the description or correcting minor mistakes. If there are too many coefficients to edit, we suggest you to create a new set and set this record to inactive instead.

Uncertainty coefficients do not have comment feature. Put short comments in the description text box if you like.

You can paste the coefficient numbers from Microsoft Excel or other spreadsheet editing software, as long as there are 4 columns and equal number of rows. Click **Paste** link above the grid to paste the numbers. The **Reset** link resets all numbers in the grid back to zero. Both *Repeatability Coefficients* tab and *Response Concentration Coefficients* tab have their own Paste and Reset command link.

When you finished editing the numbers and the description, click **Save** button or go to Action menu > **Save Changes** to commit the change. The form exits its edit mode and becomes read-only again.



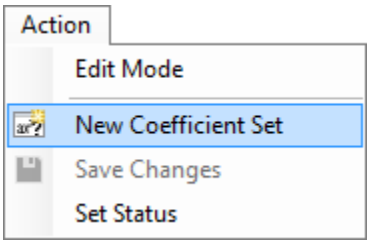
Otherwise to cancel editing and discard all of your changes, open Action menu and select **Edit Mode** again to remove its tick mark. This will exit edit mode and reload the coefficient set from the database.

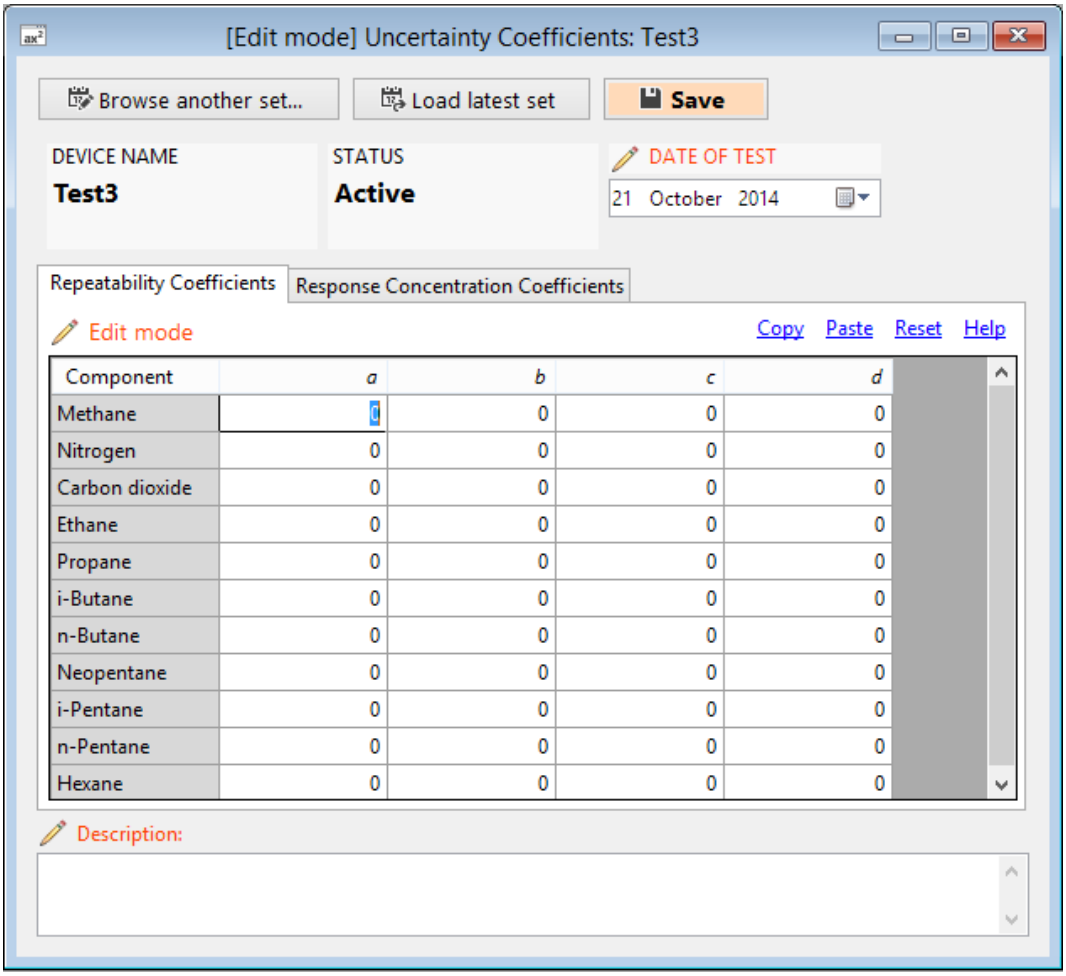
12.4 Create New Coefficient Set

Creating a new set instead of editing an existing set over and over again provides some advantages, such as

- You have a historical record of coefficient sets. When the annual multilevel calibration is conducted, it generates a new set and this should be entered as a new set too.
- You can test several sets with minor differences in the Uncertainty Calculator form. Make sure to write the correct description for the uncertainty set in order to avoid confusion when selecting the coefficient record in Uncertainty Calculator.

From an open Uncertainty Coefficients form, open the Action menu and select **New Coefficient Set**. This menu creates a blank coefficient set (all zeroes) with the timestamp set to current computer time.





Begin entering the coefficient numbers one by one. Be watchful for potential human error. Alternatively, you can paste the coefficients from Microsoft Excel or other spreadsheet editing software as long as there are 4 columns and equal number of rows. Click **Paste** to do so.

Enter both coefficient sets. Switch tab to move from repeatability coefficients to response concentration coefficients or vice versa. If you forget to enter coefficients for the other tab, GCAS Desktop will alert you if one tab has all zeroes upon save.

Don't forget to set the date of test. This is the date information of when the multilevel calibration was conducted, not the date of when these coefficient sets was entered.

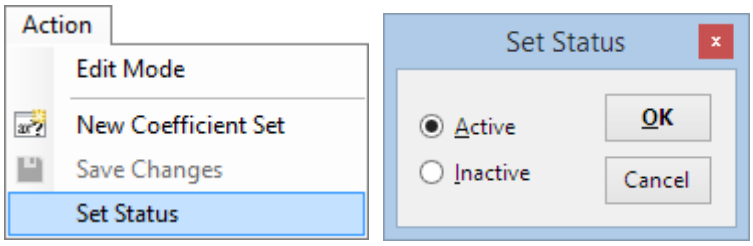
Write the description. It is a good practice to provide a description about this coefficient set.

When you are finished, click **Save** button or go to the Action menu > **Save Changes** to save these coefficients into database. Otherwise to cancel all of these, go to the Action menu > **Edit Mode** to remove its tick mark. The form will revert to the last record viewed.

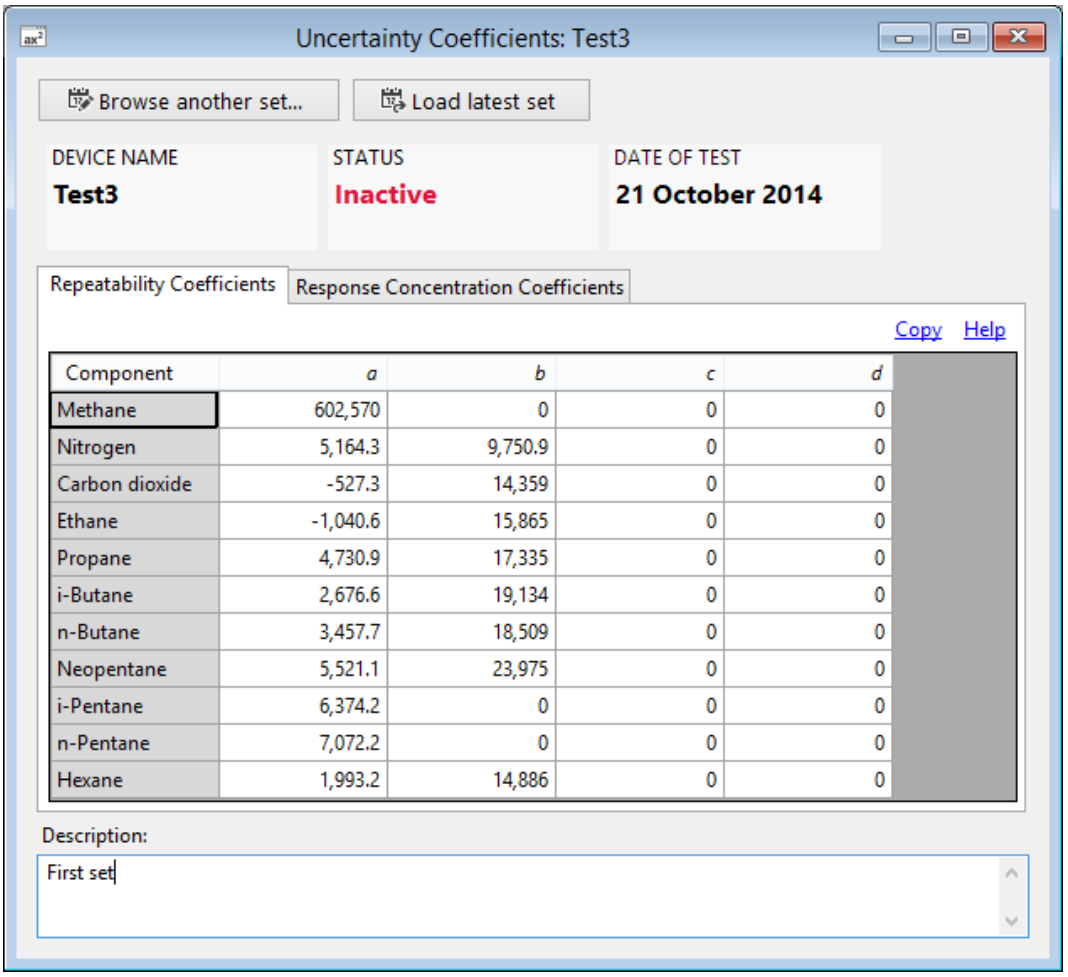
12.5 Change Record Status

Like other types of record in GCAS database, uncertainty coefficient set has a status bit indicating whether the record is active or inactive.

To change status, open the Action menu and select **Set Status**. This menu brings the *Set Status* dialogue where you can flip the status bit from active to inactive or vice versa.



Click **OK** and GCAS Desktop instructs the Uncertainty Coefficients form to reload the set with the new status.



We believe it is a good practice to provide a short note of why the set was made inactive or active. To write this note, invoke edit mode from the Action menu, write the note on the description box, and finally click **Save**.

13 Uncertainty Trend

Uncertainty Trend is a module to graph uncertainties of a GC device over time. It is equivalent to running many individual uncertainty calculations, with the same configuration, for an increasing range of calibration data, and finally plotting result numbers on a graph.

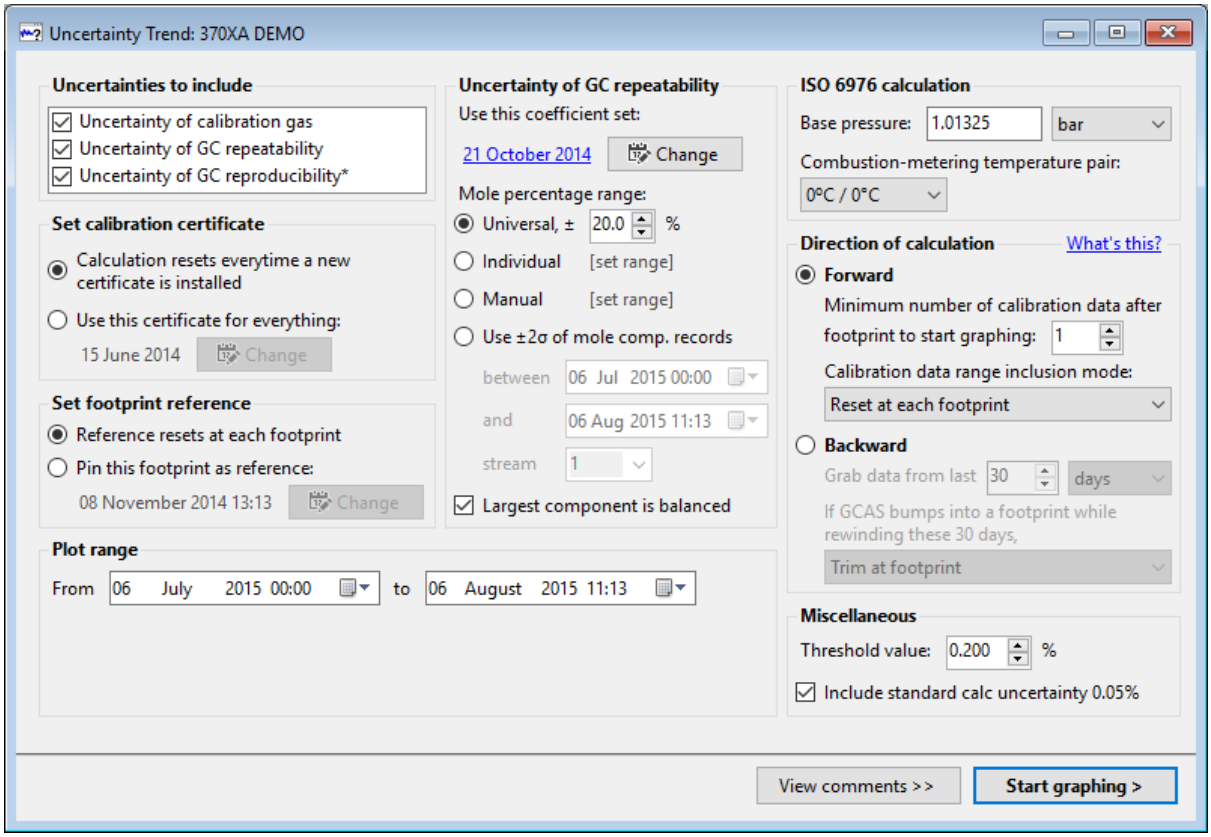
The chart has a threshold line. When uncertainty line crosses the threshold line, it is time to perform a preventive maintenance of the GC.

Note

This module requires *Uncertainty Trend* to be included in your GCAS licence.

13.1 The *Uncertainty Trend* Form

Select a device on your device panel or recent device panel, then go to the View menu > **Uncertainty Trend**.



This form has three pages: Parameter page, chart page, and comment page. The buttons at the bottom of the form do the navigation between these pages.

When Uncertainty Trend form is opened, it shows the *parameter page*. This page configures all parameters required to perform uncertainty calculation. These parameters are

- Uncertainties to include,
- Calibration certificate,
- Footprint reference,
- Uncertainty coefficients*,
- Mole percentage range*,
- ISO 6976 parameters,
- Direction,
- Plot range.

*available if Uncertainty of GC repeatability is ticked.

Each parameter is explained in chapter 13.2. After all parameters are set correctly, click **Start graphing** and GCAS Desktop will start the calculation.

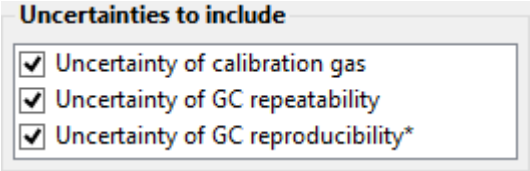
Note

Uncertainty calculation is slow because it loads many different data from database. Moreover, uncertainty trend calculation is a sequence of many uncertainty calculations. Depending on how wide your plot range and how many calibration records inside the plot range, one trend calculation may take from few seconds to ten minutes or even more. Fast CPU and good network connection between your computer and the database server help reducing the calculation time.

13.2 Uncertainty Trend Parameters

This chapter explains each uncertainty trend parameter.

13.2.1 Uncertainties to Include



As explained in chapter 11, uncertainty calculation takes up to three components: Uncertainty of calibration gas ($U_{cal\ gas}$), uncertainty of GC repeatability+linearity ($U_{repeatability}$), and uncertainty of GC reproducibility ($U_{reproducibility}$). These components may be included or excluded, which turns their values to zero if excluded.

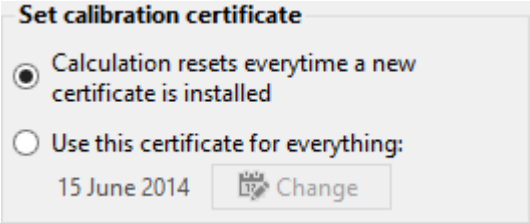
However in uncertainty trend, $U_{reproducibility}$ must be included. You see an asterisk (*) indicating that it has to be checked. The other two can be unchecked or checked.

Note

The GC device must have a calibration gas certificate. Uncertainty Trend form cannot graph your chart if there are no certificates installed.

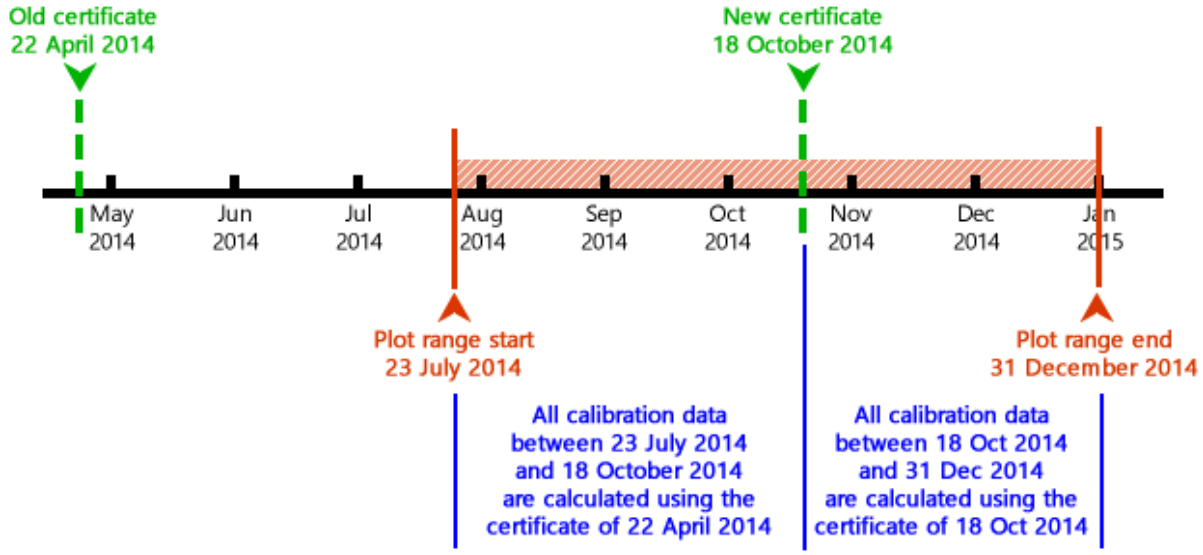
You cannot tick Uncertainty of GC repeatability if your GC device has no uncertainty coefficients stored in database. Uncertainty coefficient selection field and mole percentage range options will be disabled. To create a new coefficient set, rewind to chapter 12.4.

13.2.2 Calibration Certificate

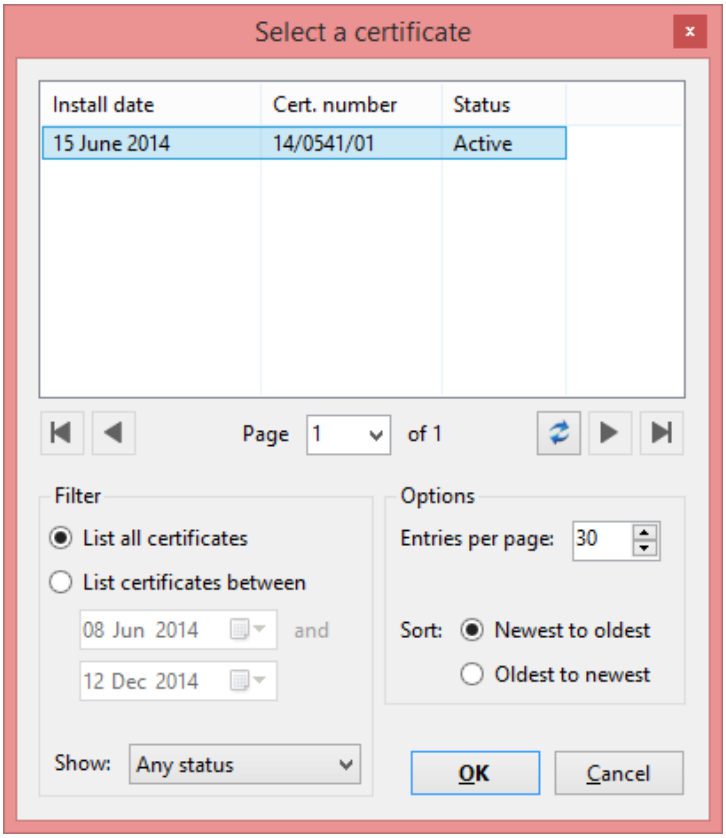

Set calibration certificate
Calculation resets everytime a new certificate is installed
Use this certificate for everything:
15 June 2014
Change

This section controls which certificates to use. There are two options: Reset calculation at each certificate, or pin a certificate for everything. The default is reset calculation at each certificate.

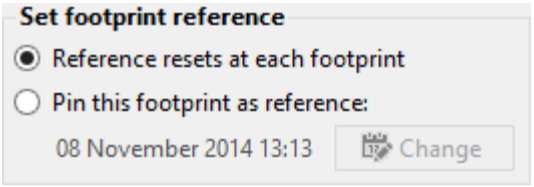
On first option, whenever a new calibration certificate installed, all data after the certificate are calculated using the new certificate.


Old certificate
22 April 2014
New certificate
18 October 2014
May 2014
Jun 2014
Jul 2014
Aug 2014
Sep 2014
Oct 2014
Nov 2014
Dec 2014
Jan 2015
Plot range start
23 July 2014
Plot range end
31 December 2014
All calibration data between 23 July 2014 and 18 October 2014 are calculated using the certificate of 22 April 2014
All calibration data between 18 Oct 2014 and 31 Dec 2014 are calculated using the certificate of 18 Oct 2014

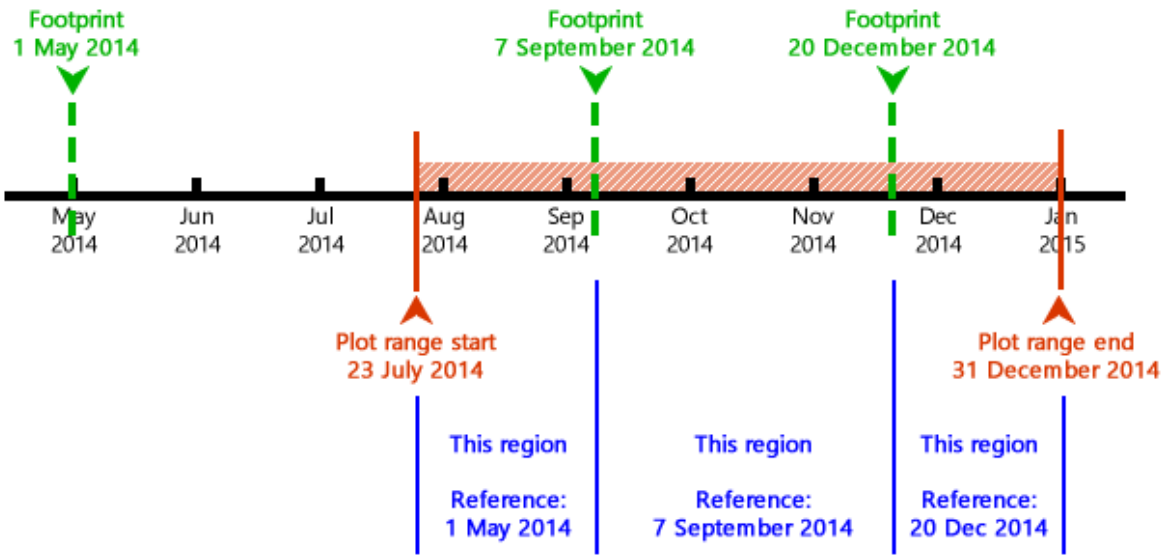
On the other hand, the second option forces the Uncertainty Trend form to use a particular calibration certificate for all data within the plot range. Click **Change** to display the *Select Certificate* dialogue and select the desired certificate.



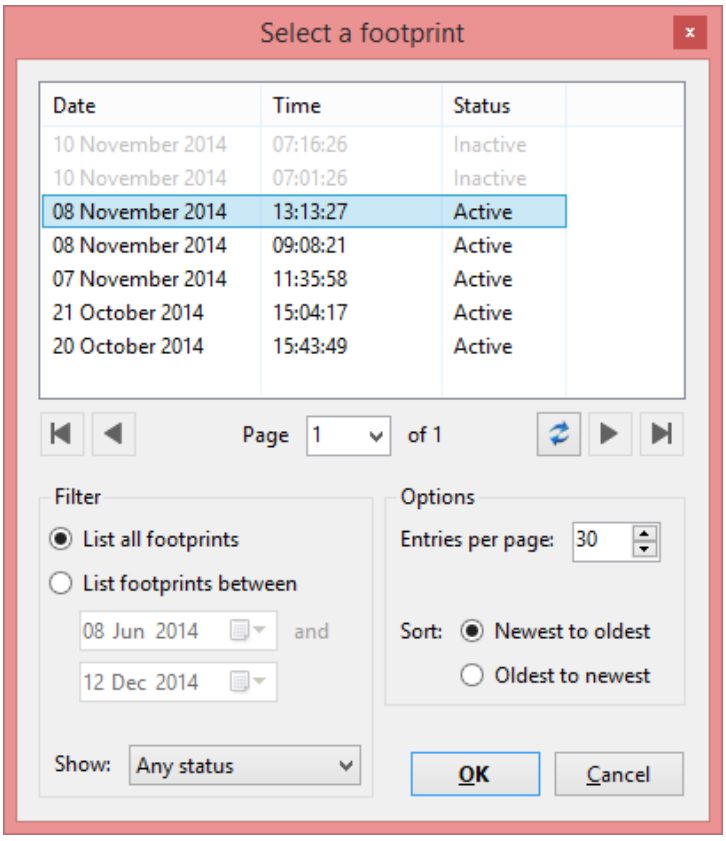
13.2.3 Footprint Reference



This section controls which footprints to use while calculating $U_{reproducibility}$. Similar to calibration certificate parameter, there are two options here: Reset reference at each footprint, or pin a particular footprint for all data. The default is reset reference at each footprint, as illustrated by the timeline below.

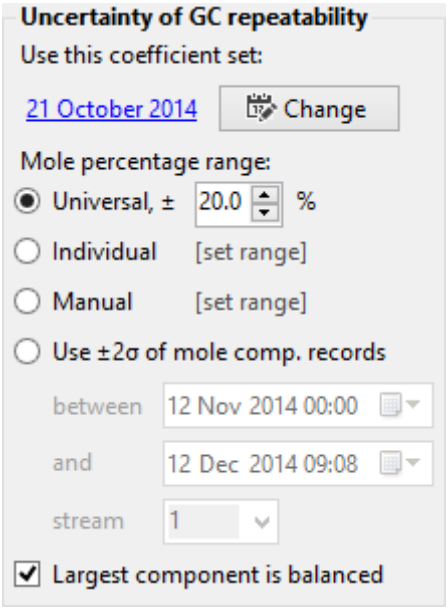


Sometimes users want to test how the uncertainty trend would turn out using several different footprints. Select the second option, then click **Change** to select the footprint.



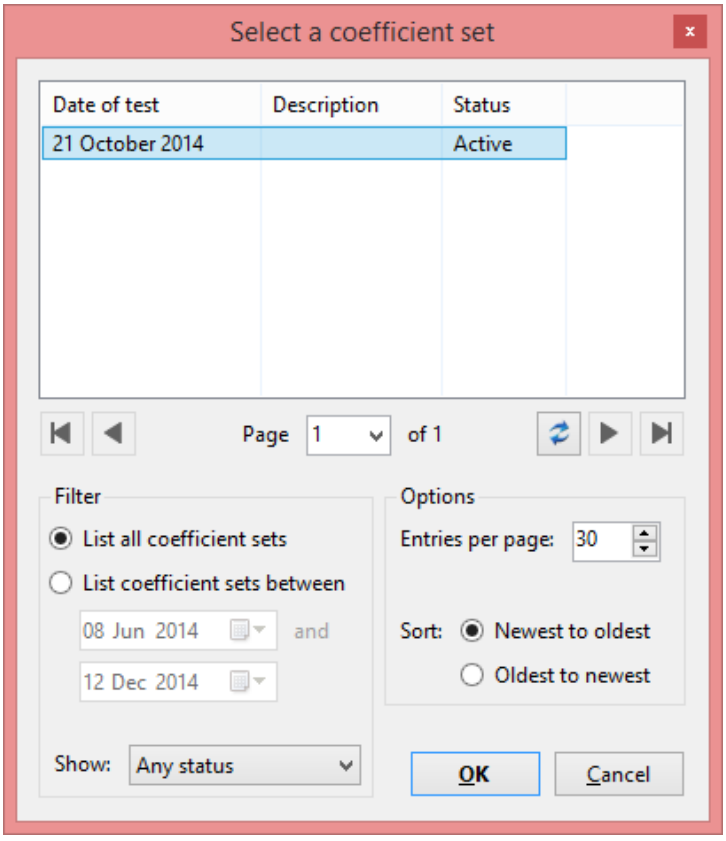
The footprint selected through this dialogue box is used to calculate $U_{reproducibility}$ of all data in the plot range, regardless of the timestamp of the footprint—even if the footprint occurs after the plot range ends.

13.2.4 Uncertainty Coefficients and Mole Percentage Range



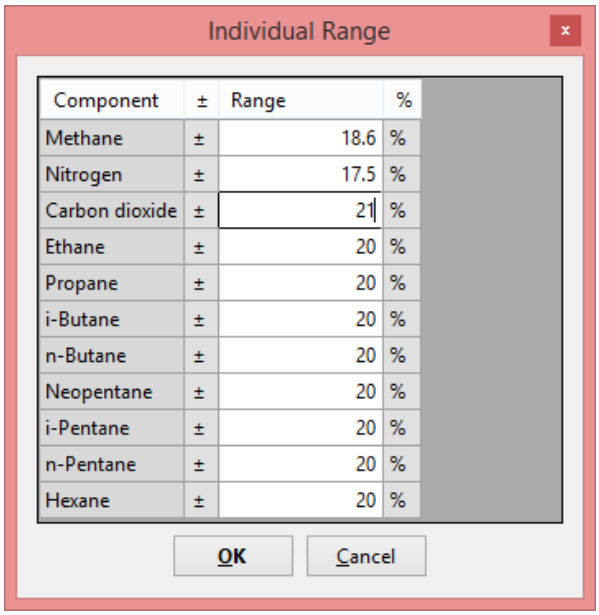
This section is available if uncertainty of GC reproducibility is checked on the first section. Your GC device must have uncertainty coefficients stored in database, otherwise you cannot tick uncertainty of GC reproducibility.

Select which coefficient set to use through **Change** button.

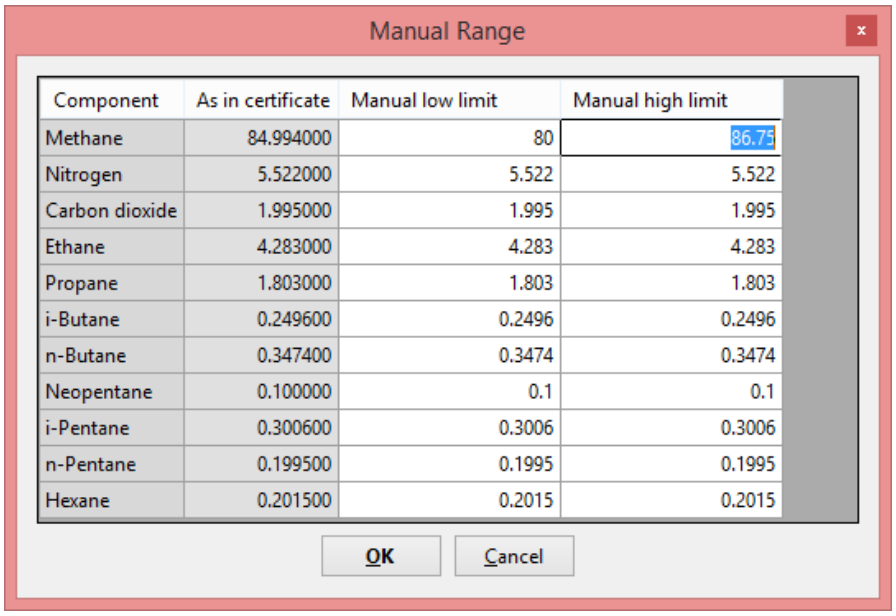


Next, choose one of the mole percentage range options.

1. **Universal**: Every component has the same plus-minus range. The default is ±20%.
2. **Individual**: Every component has its own plus-minus range. Click **Set range** to enter these individual ranges.

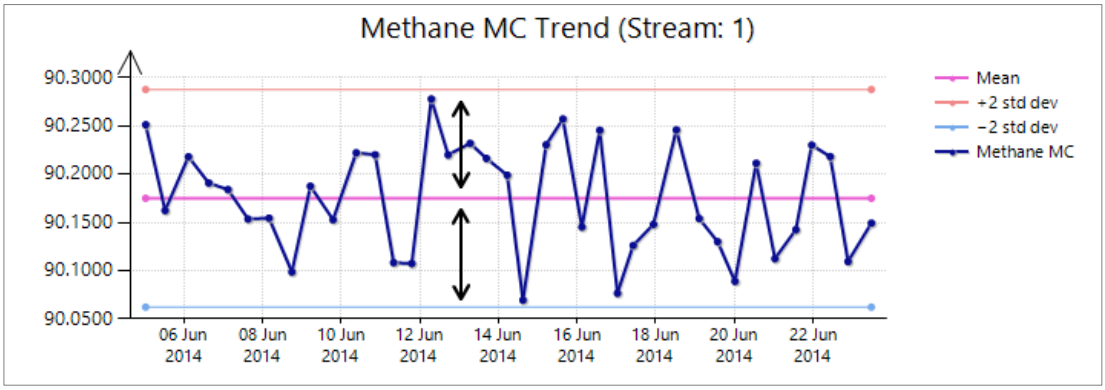


3. **Manual**: You need to explicitly set the value of lower bound and upper bound of each component. For comparison, the mole composition from the calibration gas certificate is displayed in the second column.



4. **Use plus-minus twice standard deviations**: The range is taken from twice of standard deviation of mole composition records over the specified period of time, filtered to the

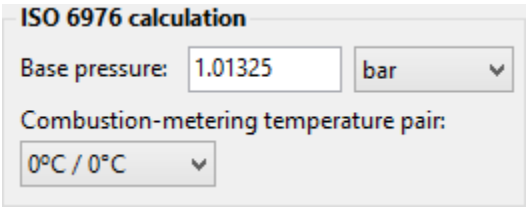
specified stream.



Finally, the last check box controls whether to treat the component having largest percentage as the balanced gas. Balanced component means its composition is not taken from the calibration certificate, but from 100% minus the others instead. Balanced gas keeps the mole percentage sum at 100%, while without balanced gas it may go over 100% and below 100%.

Unlike Uncertainty Calculator form which you can choose which one to become the balanced gas, Uncertainty Trend always selects the gas with largest mole percentage as balanced. For a rare occasion where there are multiple gases sharing the same largest percentage (e.g. two gases have 40% each), GCAS Desktop selects the first gas as the balanced one. Gases are sorted using RF sort order.

13.2.5 ISO 6976 Parameters

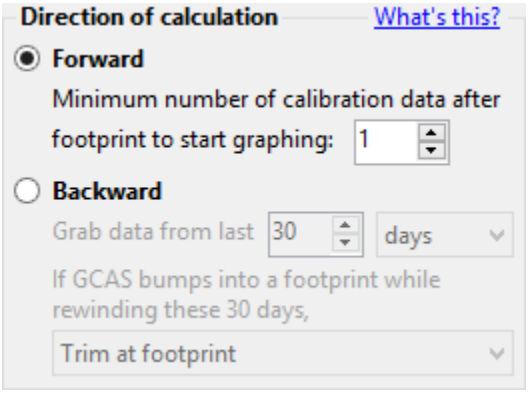


This section contains the base pressure and combustion-metering temperature pairs. These parameters are used for all data within the plot range.

Default base pressure is one atmosphere, or 1.01325 bar. GCAS Desktop supports six combustion and metering temperature pairs, which are:

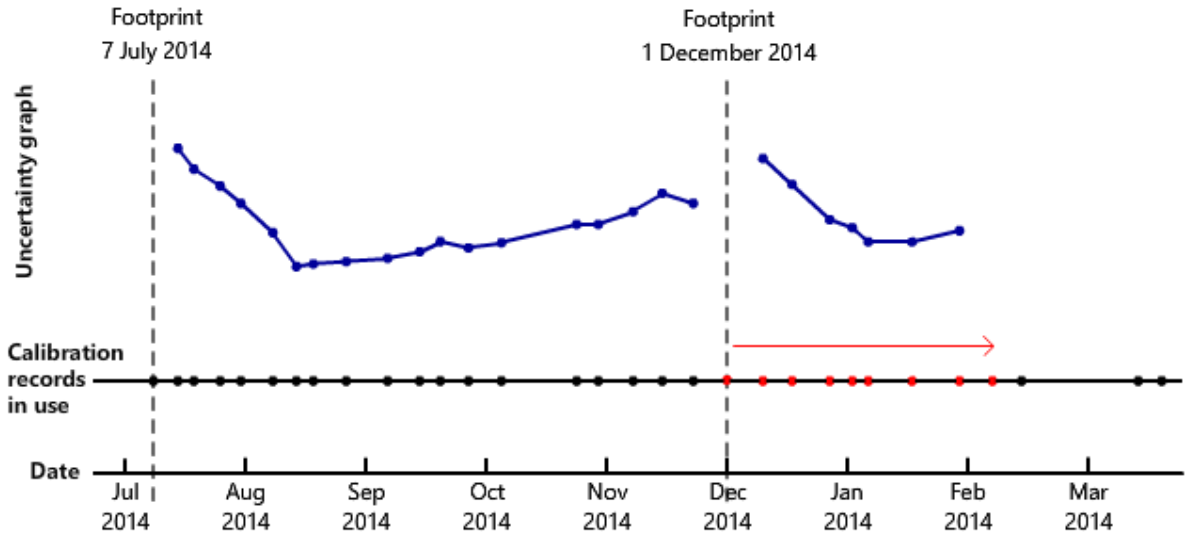
- 0°C / 0°C
- 15°C / 0°C (combustion temperature = 15°C, base temperature = 0°C)
- 25°C / 0°C
- 15°C / 15°C
- 20°C / 20°C
- 25°C / 20°C

13.2.6 Direction



Direction of calculation determines which calibration records to include in the calculation. Uncertainty calculation may go *forward* or *backward*.

On **forward** direction, list of calibration data to include is counted from footprint. For every calibration data in the plot range, calculation of $U_{reproducibility}$ at that point will include all calibration data from the last footprint (including the last footprint itself) and accumulatively go *forward* up to that point.



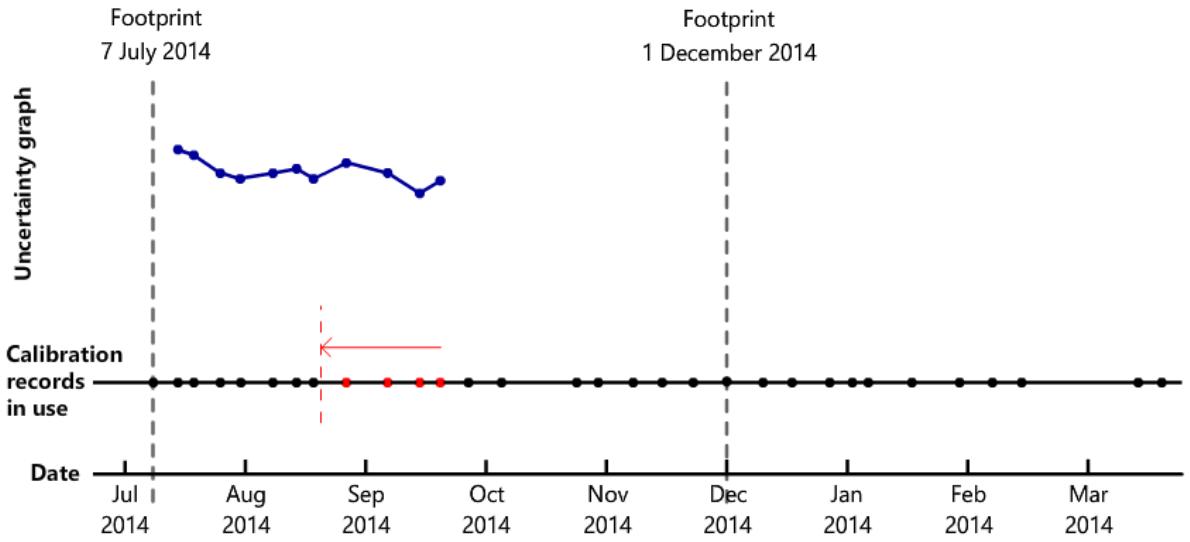
(This picture is animated in the HTML version of GCAS Desktop Manual.)

Do not confuse "the last footprint" in the previous paragraph with the "reference footprint". *Reference* footprint is set on this section. The *last* footprint only marks where the collection of calibration data begins. Reference footprint and "last" footprint may co-incide, but that is not always the case. You can pin any footprint as a reference, but uncertainty calculation in forward direction uses one last footprint before every single dot on the chart. Actually it uses the *timestamp* of last footprint, in order to query calibration records *from* the timestamp of last footprint *to* the timestamp of the current dot being calculated.

There is a minimum limit to start calculation. The default is one (1), which means forward calculation can start at one calibration data after every footprint within the plot range. You can set the minimum

for example, ten, so the calculation starts after 10 calibrations following every footprint. You will see a gap on the chart after every footprint indicating the number of dots within those gaps is below the minimum limit, therefore calculation could not start.

On **backward** direction, list of calibration data to include is counted from the calibration data being calculated. For every calibration data in the plot range, calculation of $U_{reproducibility}$ at that point will include all calibration data from that point and go *backward* to the last *x* days or last *x* record before that point.

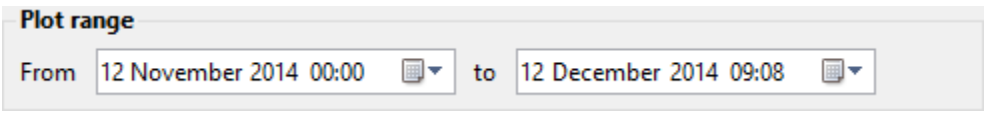


(This picture is animated in the HTML version of GCAS Desktop Manual.)

Set how many days or how many records to travel backwards. The default is 30 days. You can go backward to as far as 2 years (730 days). At some occasions the GC devices has 30 data in one day; you might consider to go backward 30 records, not days.

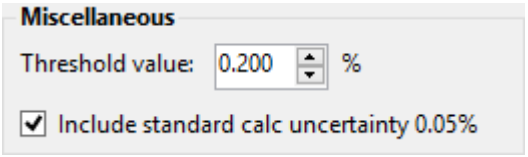
When GCAS Desktop travels backward, it may find a footprint before it fulfils the specified *x* days or *x* records. Decide what GCAS Desktop should do when it bumps into a footprint, whether to stop or to continue. The default is stop at footprint (trim at footprint). By stopping at footprint, the number of calibration data included in the calculation is less than *x* days or *x* records, but GCAS Desktop does not include data before the footprint which are usually calibrated under different configuration.

13.2.7 Plot Range



Set the plot range start and end date. GCAS Desktop displays a warning label if the footprint reference is a pinned footprint and that footprint occurs within this plot range or after this plot range.

13.2.8 Miscellaneous

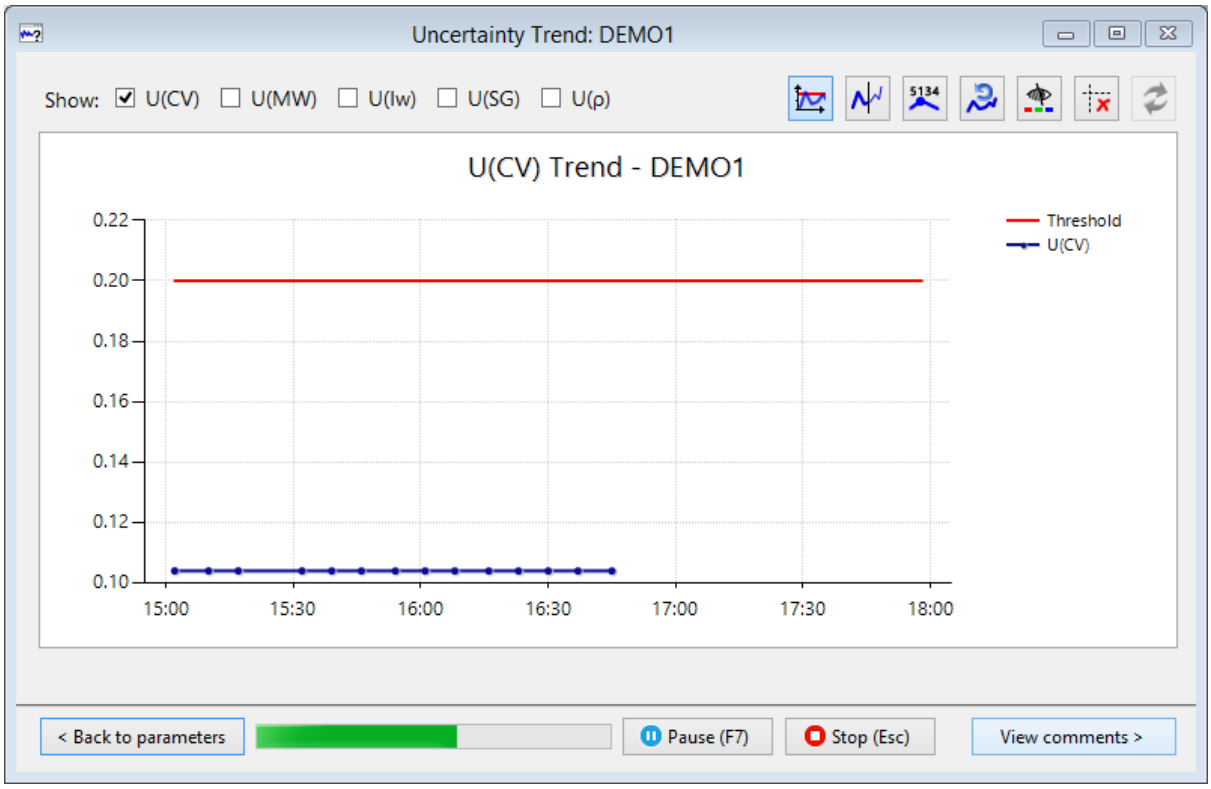


This section sets the threshold line on the chart. The default is 0.2%. When the uncertainty chart line crosses the threshold line, it is recommended to perform a preventive maintenance on your GC.

The checkbox **include standard calculation uncertainty 0.05%** controls whether ISO 6976 standard measurement error of 0.05% (or 0.1% at k = 2) should be included in the final calculation of each data point in the chart. By default, this check box is ticked.

13.3 Uncertainty Trend Chart

Once you set all the required parameters, click **Start graphing** at the bottom of the form. Uncertainty Trend form switches to *chart* page and begins the calculation.



Calculation in progress.

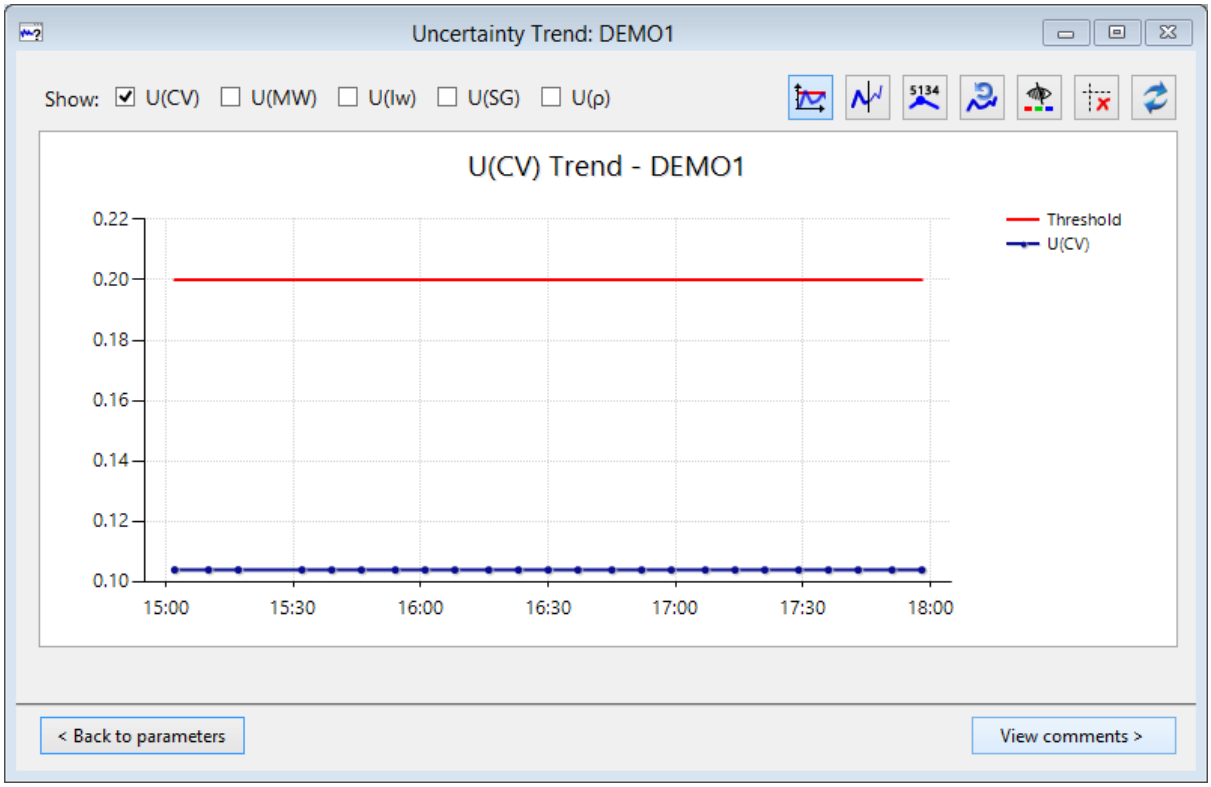
Note

Uncertainty calculation is slow because it loads many different data from database. Moreover, uncertainty trend calculation is a sequence of many uncertainty calculations. Depending on how wide your plot range and how many calibration records inside the plot range, one trend calculation may

take from few seconds to ten minutes or even more. Fast CPU and good network connection between your computer and the database server help reducing the calculation time.

Because uncertainty trend calculation is slow, GCAS Desktop provides **Pause** button to temporarily halt the calculation and **Stop** button to abort the calculation. The keyboard shortcut F7 is designated for Pause button and Esc for Stop button. While calculation is in progress, you cannot use other modules or they will run slower than usual. This is because the database server is busy serving the data required for uncertainty calculation.

This is how the form looks like after the calculation is finished.

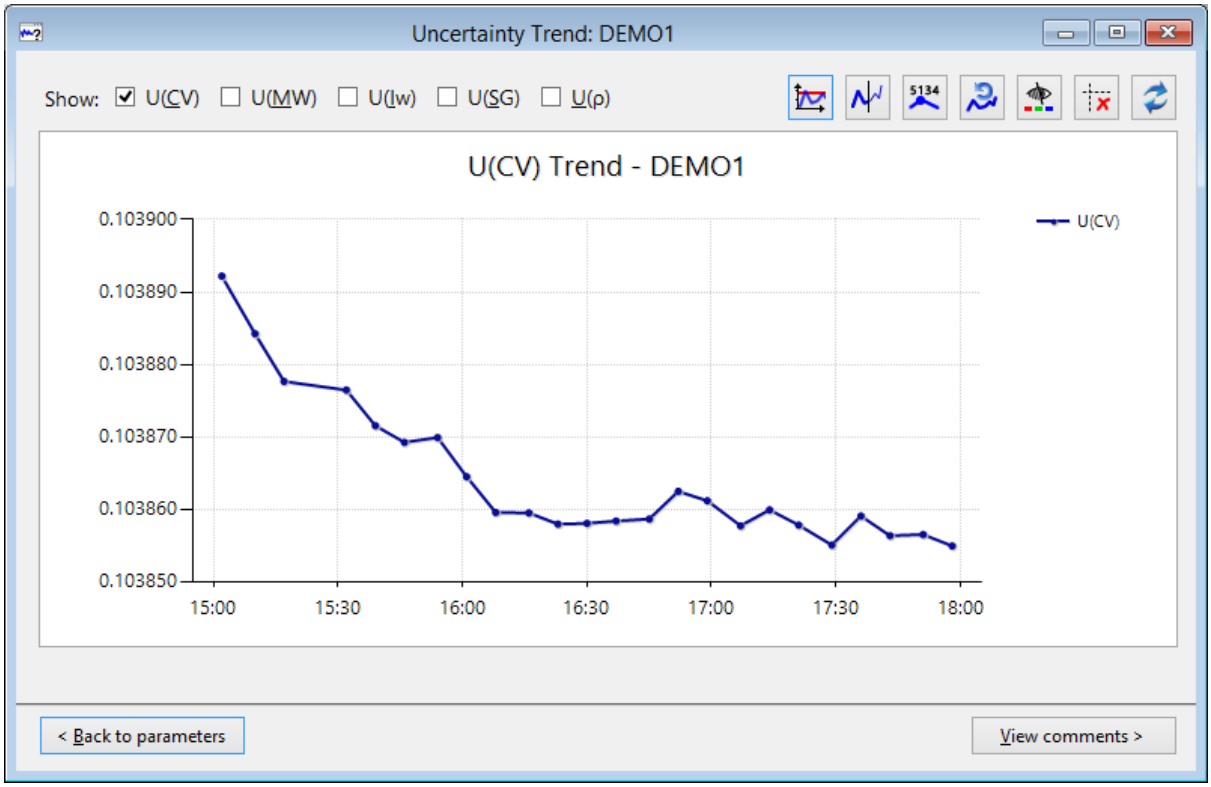


This is an example of a healthy GC. The blue uncertainty line is below the red threshold line. Actually, there are *five* lines:

- Uncertainty of calorific value – U(CV)
- Uncertainty of molecular weight composition – U(MW)
- Uncertainty of Wobbe index – U(I_W)
- Uncertainty of relative density or specific gravity – U(SG)
- Uncertainty of standard density – U(ρ)

The five check boxes at the top of the form control whether to show or hide the corresponding line chart. By default, GCAS Desktop only displays the uncertainty of calorific value because it is the most interesting property.

Below is the same chart with the threshold line hidden from view. The Y-axis scale adjusts itself accordingly so the variations of the uncertainty values become more clear. To show or hide the threshold line, click **Show threshold line** or right click the chart and select **Show Threshold Line**.



To go back to the parameter page, click **Back to parameters** at the bottom of the form. To read or write comments instead, click **View comments**.

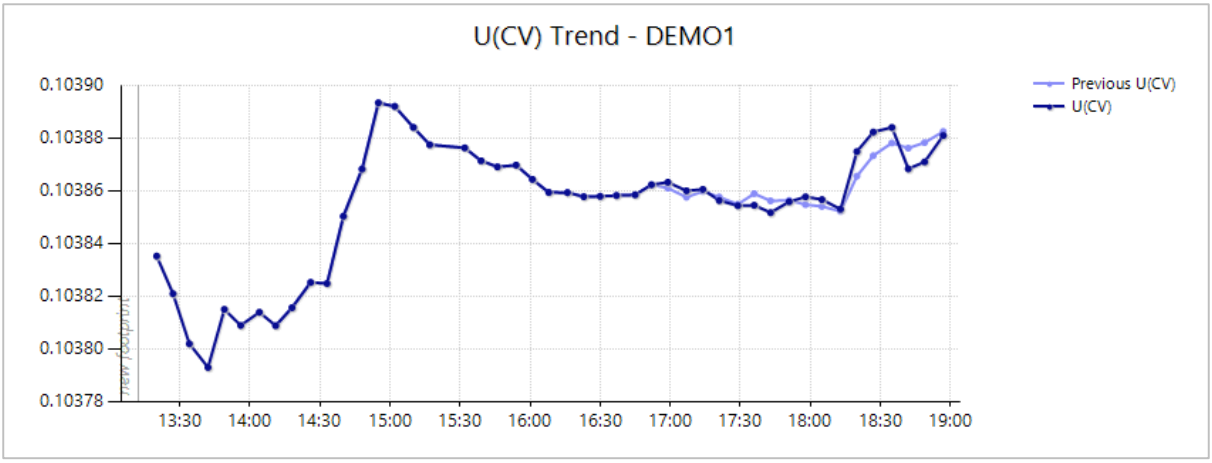
Note

If you went back to the parameter page but didn't change anything then clicked **Start graphing**, the form quickly returns to the chart view. However if you changed one thing on the parameters, **Start graphing** button will clear the chart and initiate a recalculation.

13.3.1 Comparing Previous Chart

Uncertainty Trend form remembers one last set of charts everytime it performs a complete calculation. Once the calculation completes, you can compare the current chart to the previous chart. A typical scenario is first you graph a chart, go back to the parameters page, change one or two things, and finally graph a new chart.

Show previous chart button displays current chart (of current parameters) on top of previous chart (of previous parameters). Previous charts have the same colour, only lighter. All five line charts have their "previous" line charts.

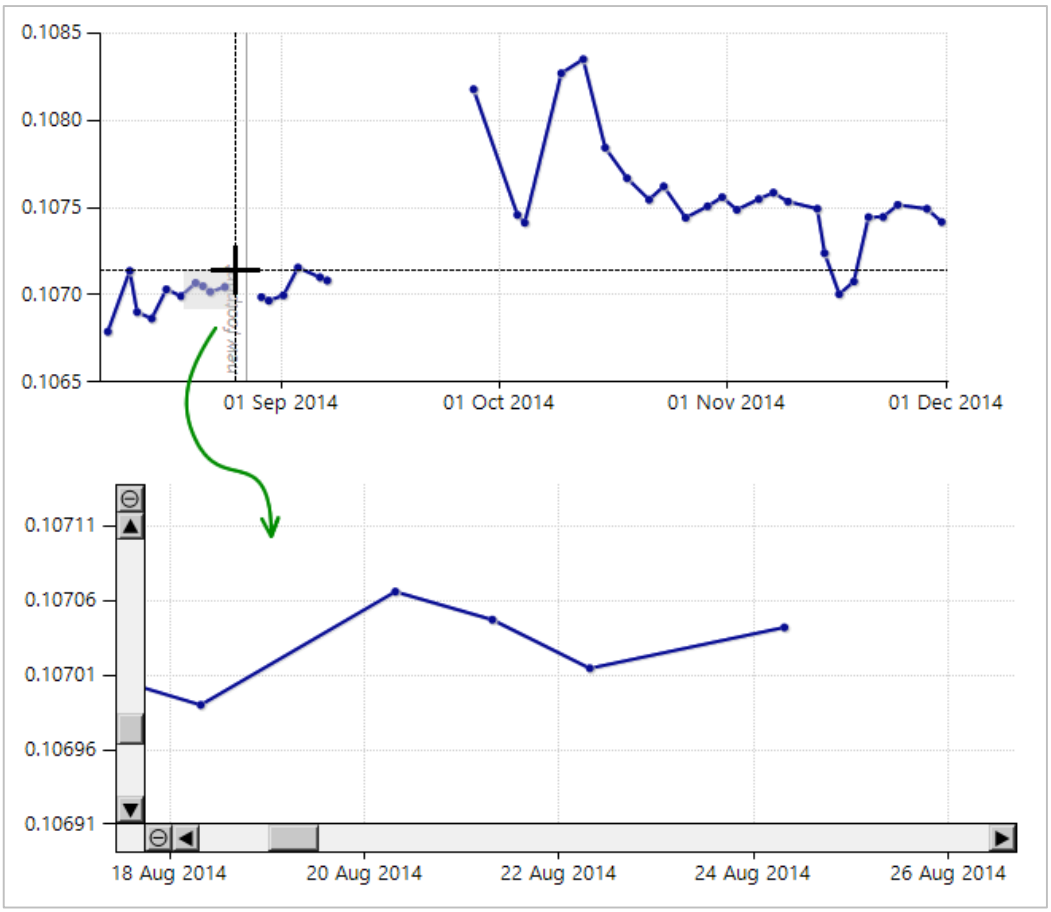


In the example screenshot above, previous U_{CV} (light blue) is forward calculation with minimum 2 data to start calculation. Current U_{CV} (dark blue) is backward calculation, going backward 30 records and trim at footprint. They co-incide until the 30th dot then they start to diverge.

Be aware that **Refresh** button will erase previous chart prior to the recalculation.

13.3.2 Zoom and Scroll

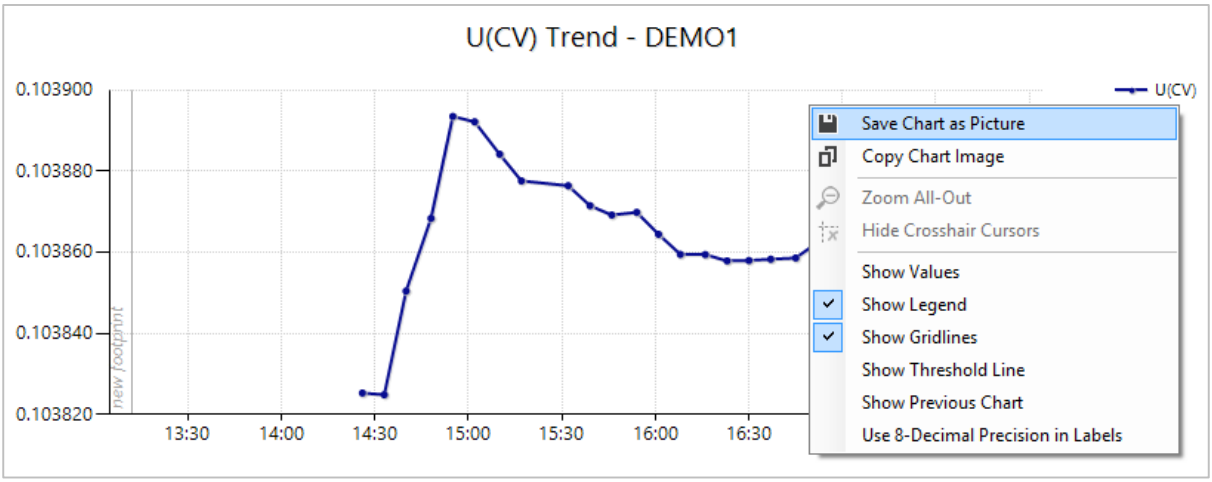
Drag a rectangle over the area you want to zoom in. Pan around the chart using the provided scroll bars. Drag another rectangle to zoom in further.



To zoom out, click the circled minus button ⊖ on both scroll bars. Press Home on your keyboard or right click the chart and select **Zoom All-Out** to undo all zoom-in operations.

13.3.3 Save or Copy the Chart

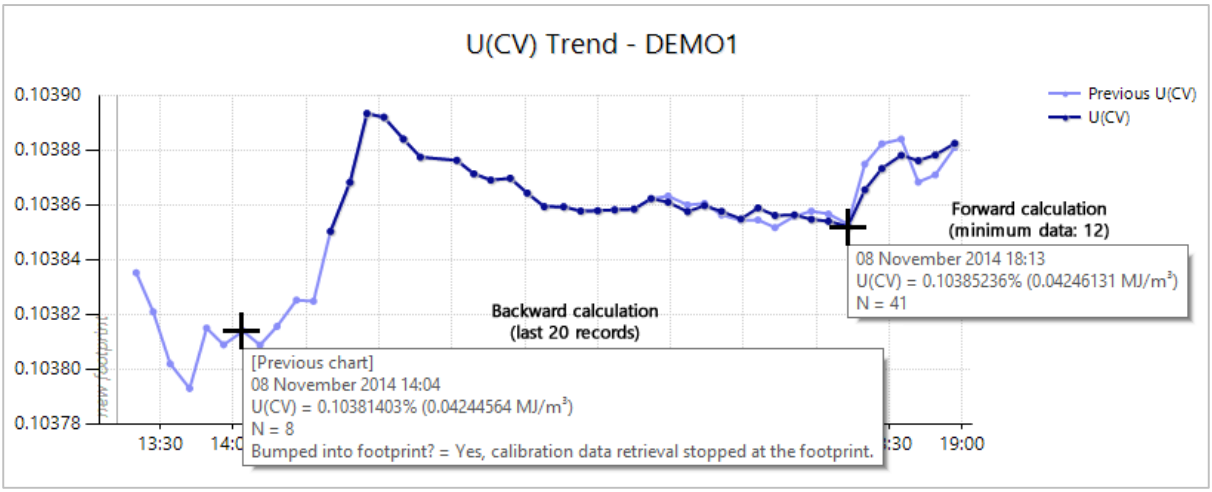
To save the chart as image file, right click on the chart and select **Save Chart as Picture**.



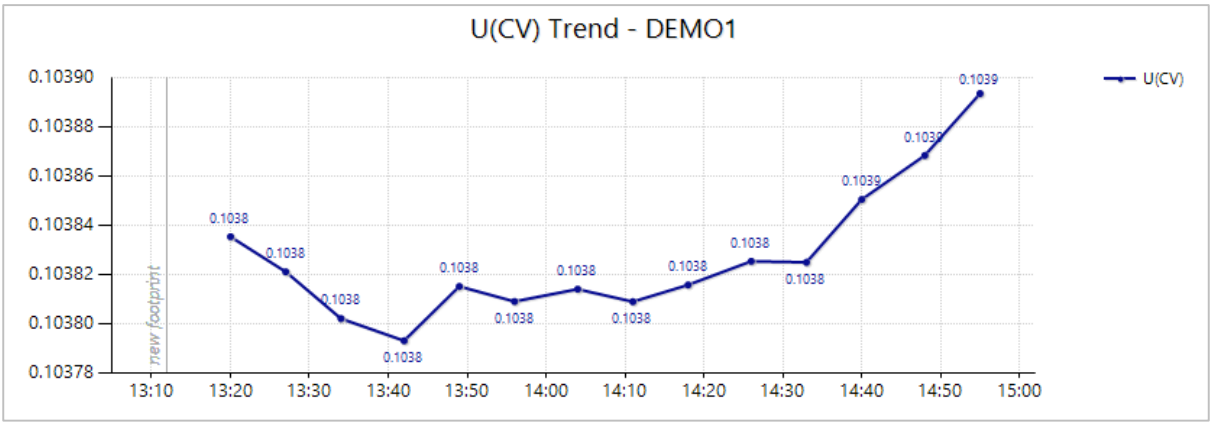
Similarly to copy the chart into clipboard, right click and select **Copy Chart Image**. Then you may paste the image onto Microsoft Paint, Microsoft Word, or any software that accepts bitmap image.

13.3.4 Other Visual Cues

Hover your mouse pointer over a data point on the chart to reveal a tooltip about that point. Typically the tooltip displays the X-axis value (the date and time value), Y-axis value, and the *N* (number of calibration data used to calculate the uncertainty at this point). For backward calculation, the tooltip has additional info whether GCAS Desktop bumped into footprint, and if so, whether the backward iteration stopped at footprint or continued through.

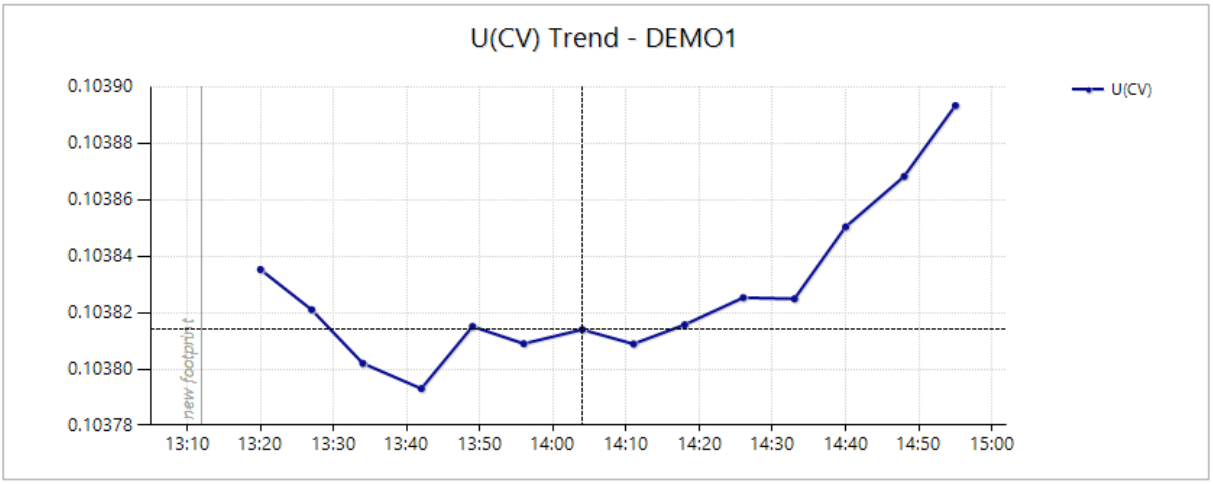


Press **Show values** or right click the chart and select **Show Values** to display the uncertainty values. Be aware that too many data points on the chart will clutter the chart view.

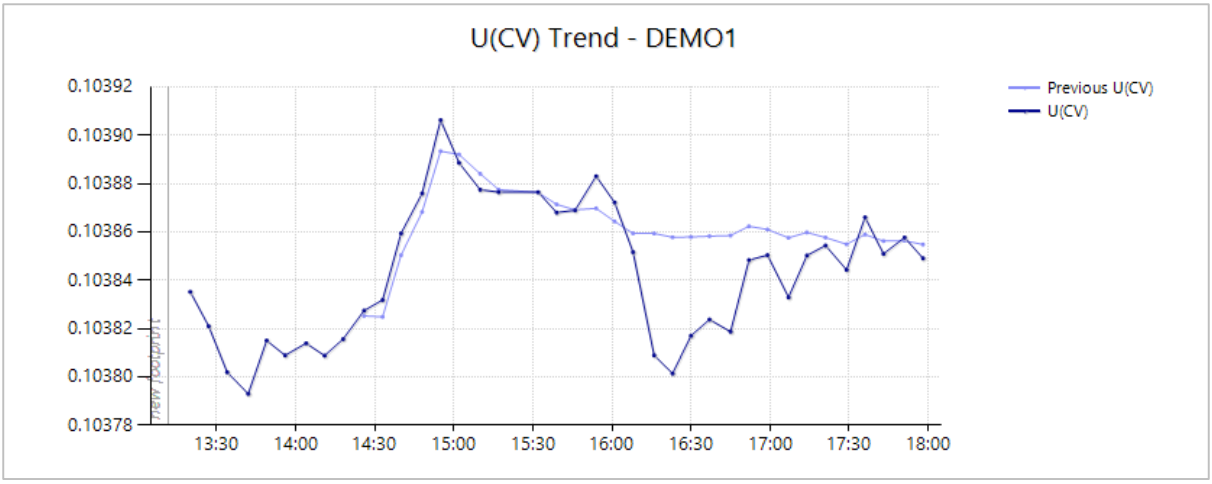


GCAS Desktop displays four digits after decimal points. Should you need a higher precision, right click the chart and select **Use 8-Decimal Precision on Labels**. Now the labels display 8 digits after decimal points.

These dotted lines are called *cursors*. Cursors appear when you (left)click on a chart or as a remnant of zoom operation. Cursor may act as a guide to compare Y-axis values of two data points. Click **Hide crosshair cursors** or right click on a chart and select **Hide Crosshair Cursors**.



In several occasions when you are comparing current chart to previous chart, the two lines come so close that the current line chart obscures the previous line chart. Click **Use thin lines** in order to make all line charts be one pixel wide, making it easier to see two lines that are too close to each other.

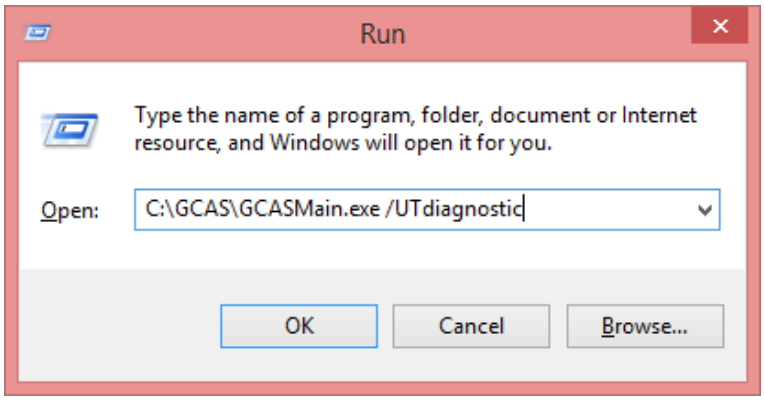


13.3.5 Colourblind Assistance

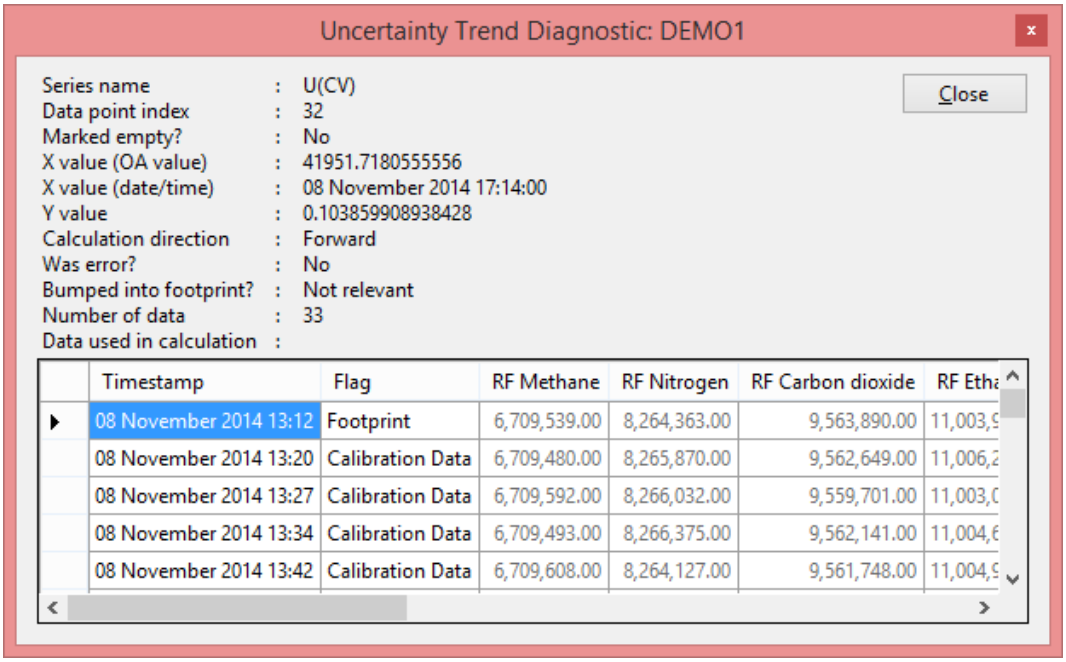
To aid users with colour blindness (protanopia and deuteranopia), GCAS Desktop provides an alternative colour scheme for the chart. Use the **Colourblind assist** button to switch colour scheme.

13.3.6 Uncertainty Trend Diagnostic

Should you notice the uncertainty trend chart has some erroneous data points, the calculation at that point might have included too few or too many calibration data. To see exactly which records were included in the calculation of a data point, run GCAS Desktop with additional **/UTdiagnostic** parameter. (UT = Uncertainty Trend)



With uncertainty trend diagnostic mode activated, **click** on any dot on the chart. GCAS Desktop displays the *Uncertainty Trend Diagnostic* form that lists the calibration records used to calculate the uncertainties of this dot.


Uncertainty Trend Diagnostic: DEMO1
Close
Series name : U(CV)
Data point index : 32
Marked empty? : No
X value (OA value) : 41951.7180555556
X value (date/time) : 08 November 2014 17:14:00
Y value : 0.103859908938428
Calculation direction : Forward
Was error? : No
Bumped into footprint? : Not relevant
Number of data : 33
Data used in calculation :
Timestamp | Flag | RF Methane | RF Nitrogen | RF Carbon dioxide | RF Eth
08 November 2014 13:12 | Footprint | 6,709,539.00 | 8,264,363.00 | 9,563,890.00 | 11,003,
08 November 2014 13:20 | Calibration Data | 6,709,480.00 | 8,265,870.00 | 9,562,649.00 | 11,006,
08 November 2014 13:27 | Calibration Data | 6,709,592.00 | 8,266,032.00 | 9,559,701.00 | 11,003,
08 November 2014 13:34 | Calibration Data | 6,709,493.00 | 8,266,375.00 | 9,562,141.00 | 11,004,
08 November 2014 13:42 | Calibration Data | 6,709,608.00 | 8,264,127.00 | 9,561,748.00 | 11,004,

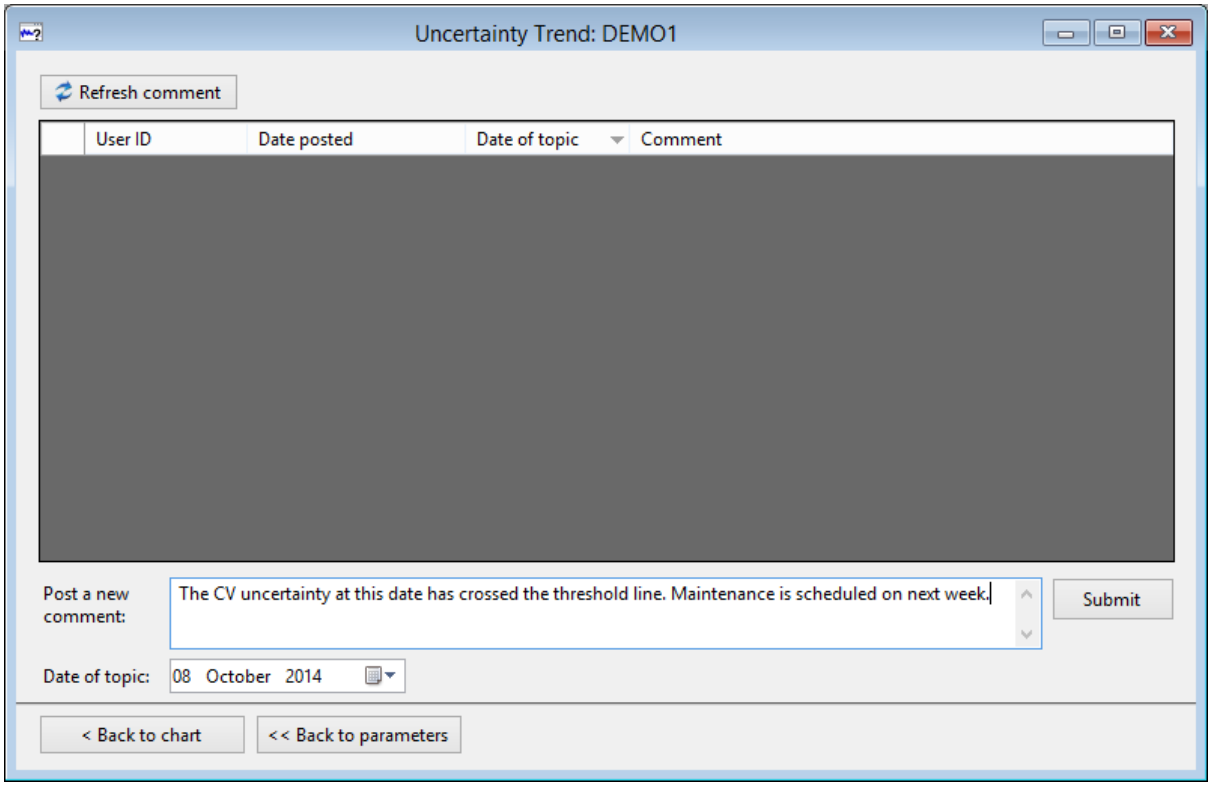
Forward calculation must include the last footprint before this data point. Hence this is what we meant by "last footprint" in chapter 13.2.6, not the "reference footprint". This footprint should be at the first row on this grid.

Backward calculation may or may not have footprints in this grid view. For example, you are graphing uncertainty trend with backward calculation for 30 days. If the footprint was 40 days ago, that footprint won't be included in the calculation. On another data point where the footprint was 25 days before; this footprint should be at the last row if you set the form to trim at footprint. If you set to continue through (i.e. include data before footprint) there may be more records preceding this footprint.

Had the records on the displayed grid do not conform to the two paragraphs above, this indicates a bug. Kindly please report the bug to support@i-Vigilant.com.

13.4 Insert Comment

Click **View comments** button at the bottom of the Uncertainty Trend form. This button brings you to the *comment* page. Comments on this form is similar to comments on Data Analysis; the comments aren't bound to a particular record. Instead, you need to provide the **date of topic** so other users know the background or context of your comment.



Write your comment with the appropriate date of topic, then click **Submit**. Your comment will have a yellow background to distinguish it from comments by other users.

Make sure that the comment is correct e.g. free from spelling errors, because once submitted you would not be able to remove your comment. This is a part of audit trail requirements.

Click **Refresh comments** to reload comments.

If you do not see the text box to write your comment, i.e. you only see the comment grid view, your GCAS user account doesn't have the action permission to write comment in Uncertainty Trend. Contact your GCAS administrator.

14 Uncertainty Trend Comparison

Under construction

Uncertainty Trend Comparison is a planned module to compare uncertainty trends across devices. When this module becomes available, this chapter will be updated. Stay tuned for future releases of GCAS Desktop.

Note

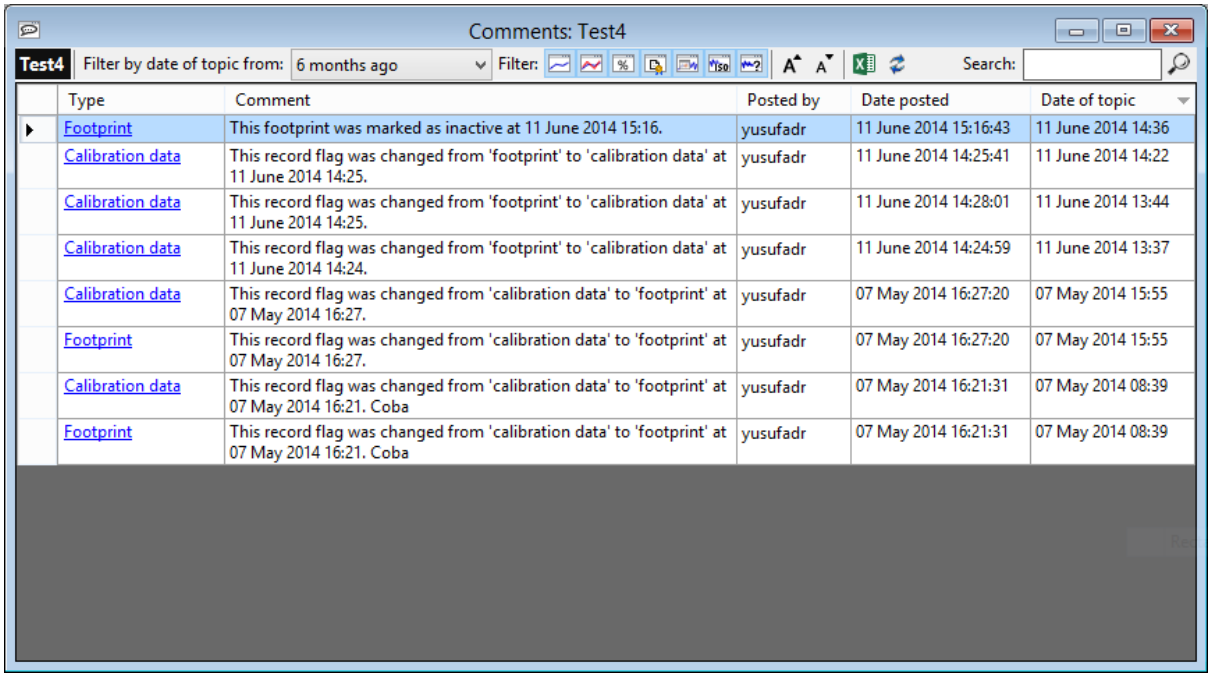
This module requires two GCAS features to be included in GCAS licence: *Uncertainty Trend* and *Data Comparison*.

15 Comments

All user comments, e.g. on Footprint form, Calibration Data form, Mole Composition form, Calibration Gas Certificate form, Data Analysis form, Repeatability Test module (only on GCAS Web), Uncertainty Trend form, and ISO 6976 Trend form, are consolidated in the Comments form.

15.1 The *Comments* Form

To view user comments of a certain device, select that device on your device panel and go to the View menu > **Comments**.


Comments: Test4
Test4
Filter by date of topic from:
6 months ago
Filter:
Search:
Type
Comment
Posted by
Date posted
Date of topic
Footprint
This footprint was marked as inactive at 11 June 2014 15:16.
yusufadr
11 June 2014 15:16:43
11 June 2014 14:36
Calibration data
This record flag was changed from 'footprint' to 'calibration data' at 11 June 2014 14:25.
yusufadr
11 June 2014 14:25:41
11 June 2014 14:22
Calibration data
This record flag was changed from 'footprint' to 'calibration data' at 11 June 2014 14:25.
yusufadr
11 June 2014 14:28:01
11 June 2014 13:44
Calibration data
This record flag was changed from 'footprint' to 'calibration data' at 11 June 2014 14:24.
yusufadr
11 June 2014 14:24:59
11 June 2014 13:37
Calibration data
This record flag was changed from 'calibration data' to 'footprint' at 07 May 2014 16:27.
yusufadr
07 May 2014 16:27:20
07 May 2014 15:55
Footprint
This record flag was changed from 'calibration data' to 'footprint' at 07 May 2014 16:27.
yusufadr
07 May 2014 16:27:20
07 May 2014 15:55
Calibration data
This record flag was changed from 'calibration data' to 'footprint' at 07 May 2014 16:21. Coba
yusufadr
07 May 2014 16:21:31
07 May 2014 08:39
Footprint
This record flag was changed from 'calibration data' to 'footprint' at 07 May 2014 16:21. Coba
yusufadr
07 May 2014 16:21:31
07 May 2014 08:39

Leftmost column is the comment type, which contains information of what the comment was written for. Clicking any link inside this column will take you to the corresponding form and load that particular record.

The **Refresh** button on the toolbar reloads comments for the selected date filter and type filter.

15.2 Filter Comments by Type

You can hide or show certain types of comments. For example, you can hide all comments for footprint records. Use the seven toggle buttons on the Filter section of the toolbar.



: Show or hide comments for footprint records.
: Show or hide comments for calibration data.
: Show or hide comments for mole composition records.
: Show or hide comments for calibration gas certificates.
: Show or hide comments for data analysis module.
: Show or hide comments for ISO 6976 trends.
: Show or hide comments for uncertainty trends.

15.3 Filter Comments by Date

When you open the Comments form for the first time, it loads comments from the last three months. You can change the date filter by selecting the desired filter on the dropdown, or choose "Custom Range" and enter the desired date interval on subsequent dialogue box.



15.4 Search Comments

Type the search term in search box and then click **Search**. The search box accepts any of the following:

- Words in user comments
- Usernames,
- Full date in British English format (e.g. "07 February 2014") — this will search for any matches in both *Date of Topic* and *Date Posted* column.



Any match will be highlighted in yellow. If you do not see any results while you know there should be some, make sure the active filter does not hide some comment types or try changing the date range. To finish searching, click **Clear search results**.

15.5 Delete Comments

In order to maintain auditability, GCAS users are not allowed to remove any comments. Not even GCAS administrator can erase comments.

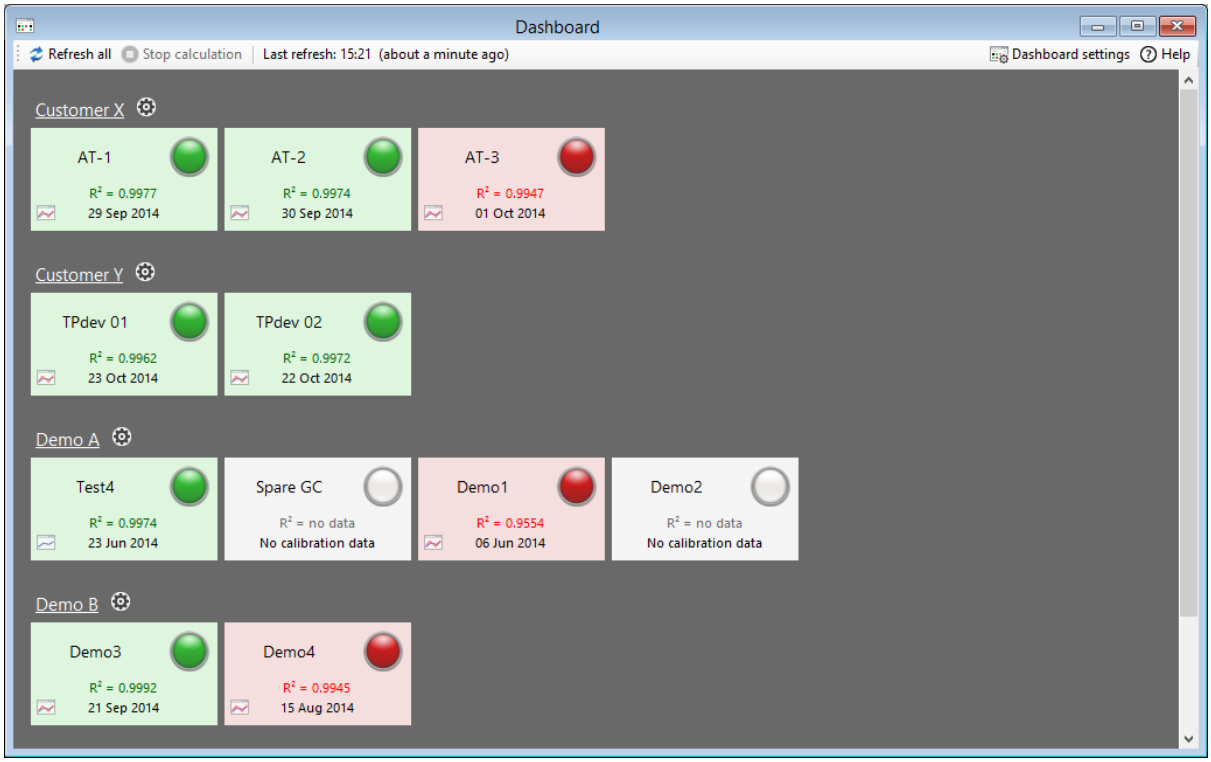
Some scenarios tolerate comment deletion. For example, you post comment in a wrong record. Or you double-post the same comment. The only way to delete your comments is to contact your database administrator (DBA) and ask him/her to remove your comments at database-level. Include

your username, the date and time when your comment was posted, timestamp of the record for which the comment was written, and the content of your comment in your enquiry.

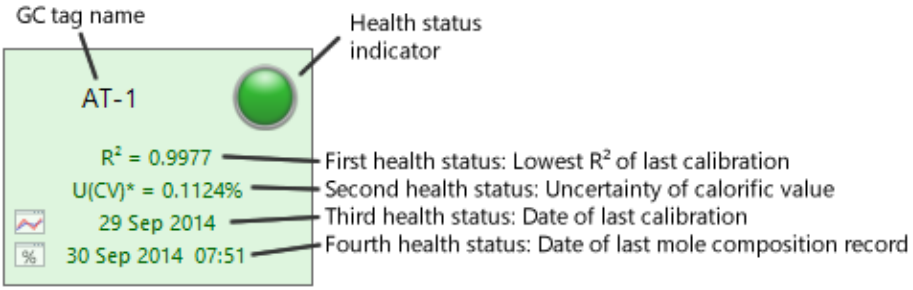
16 Dashboard

Dashboard is a place to see health status of all your GC devices in one place. This helps if you have numerous GC devices across different workspaces like one in the screenshot below. Health status of each GC device is represented by a small "LED light" on its *dashboard tile*.

To access dashboard, go to the View menu > **Dashboard**.



Each tile displays GC tag name, light indicator, and maximum 4 (four) health statuses. Choose between 1 to 4 out of 8 available health statuses to display.


GC tag name
Health status indicator
AT-1
R² = 0.9977
U(CV)* = 0.1124%
29 Sep 2014
30 Sep 2014 07:51
First health status: Lowest R² of last calibration
Second health status: Uncertainty of calorific value
Third health status: Date of last calibration
Fourth health status: Date of last mole composition record

Below are available GC health statuses to display. To customise which ones to display, visit Dashboard settings. Chapter 16.1.1 provides detailed explanation on each item.

No.	Health status	GCAS licence feature requirement
1	Lowest correlation (R^2) of last calibration	None
2	Uncertainty of calorific value	*Uncertainty Calculation*
3	Uncertainty of molecular weight composition	*Uncertainty Calculation*

4	Uncertainty of Wobbe index	*Uncertainty Calculation*
5	Uncertainty of relative density (specific gravity)	*Uncertainty Calculation*
6	Uncertainty of standard density	*Uncertainty Calculation*
7	Date of last calibration record	None
8	Date of last mole composition record	*Live Data Analysis*

GCAS Desktop on its default setting displays only two health statuses, lowest correlation (R^2) and date of last calibration. Many users with *Uncertainty Calculation* feature in their licences add uncertainty of calorific value (CV) in addition to the default two.

Date of last calibration is useful to find out which GC device has not been calibrated for a long time. Date of last mole composition record is useful to detect connection problems during unattended data capture.

The health status indicator may display one of the following:

Appearance	**Colour**	**Meaning**
	Black	- GCAS Desktop is loading or calculating the data, or - Calculation was aborted through **Stop calculation** button on the toolbar, or - All rules are turned off. This should not happen (no users should ever turn off *every* rule).
	Red	GC is not healthy. At least one health status fails.
	Yellow	Yellow represents "error" state, which is probably caused by - One or more health statuses cannot be determined because some data was missing, or - Network connection to GCAS database server goes down or interrupted while calculation was in progress.
	Green	GC is healthy. All health statuses pass.
	White	GC has no data. All health statuses have no data.

Users with colour blindness

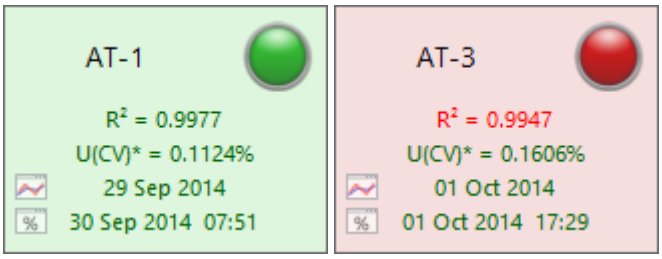


Simulated black, red, yellow, green, and white indicator in protanopia vision

GCAS Dashboard does not include alternative colour scheme for users with colour blindness. We apologise if this affects you.

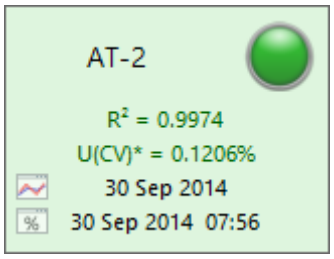
Click **Refresh** to recalculate GC health status of all devices. During refresh, the Dashboard form displays a progress bar. On slow network connection, calculation of GC uncertainties may take longer time, like half or one second per device. You may abort this calculation via **Stop calculation** button.

A healthy GC has a green tile and all health statuses are displayed using a green font. If one health status (or several) fails, the tile turns red and the offending health status(es) is displayed using red font.



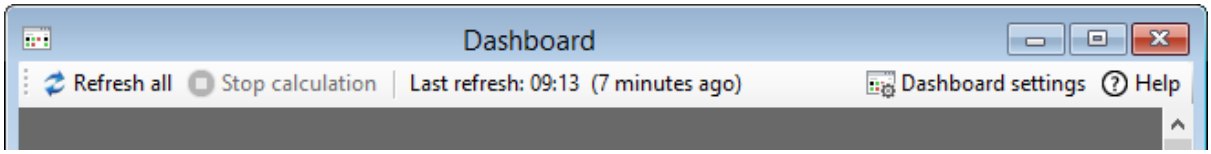
Example of a healthy GC and unhealthy GC.

When you find a health status displayed using black font, it indicates the rule for that health status is turned off. Should a rule be turned off, it does not affect the final decision whether the dashboard tile becomes green or red regardless of the health status itself passes or fails. More details about rules is on chapter 16.1.2.



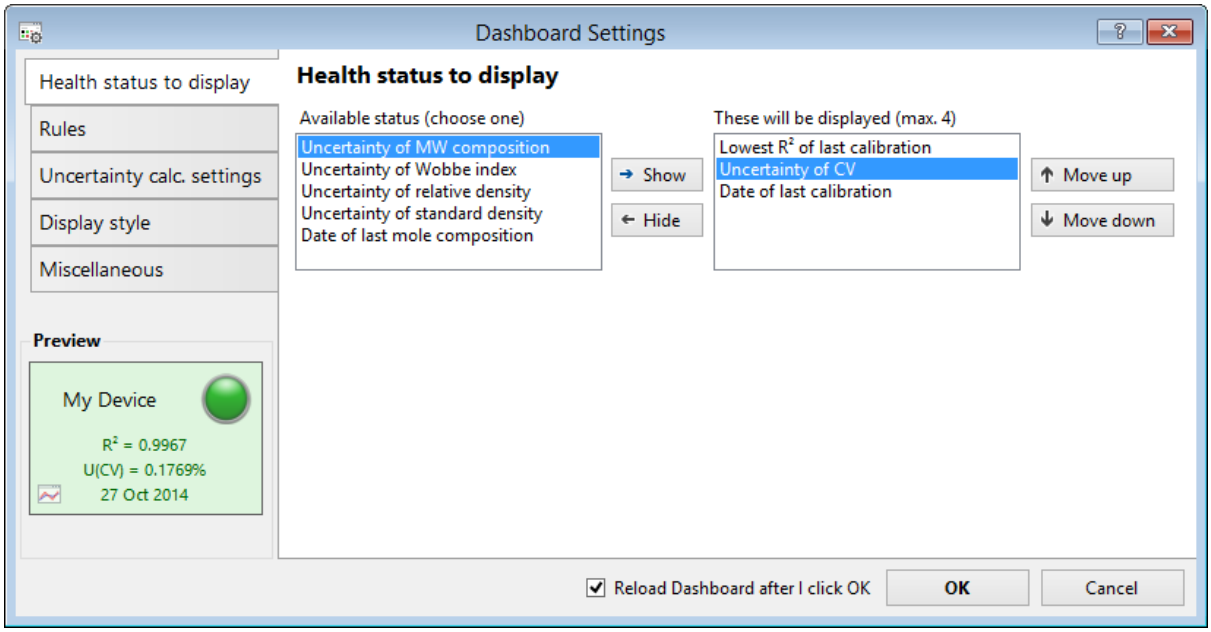
Example tile when rules for date of last calibration and date of last mole composition are turned off.

Dashboard window displays the time of last refresh on the toolbar. This information may help if you leave Dashboard open to monitor all your devices continuously. Moreover if you leave Dashboard open for a prolonged time, we recommend to turn off the idle timer in order to prevent automatic logout on inactivity. On a different topic, there is an auto-refresh timer which is configurable through Dashboard Settings dialogue.



16.1 Dashboard Settings

From an open Dashboard window, click **Dashboard settings** on the toolbar. Alternatively, return to GCAS Desktop main window and go to the View menu > Dashboard Settings. This shall bring forth the *Dashboard Settings* dialogue.



Dashboard Settings dialogue has five tabs, and each of them is explained in its own subchapters below. A preview tile is available at the left region reflecting new appearance as soon as you change a setting.

16.1.1 Health Status to Display

List box on the left contains all available GC health statuses to display. If you see some items missing, the missing items may require a GCAS feature in your GCAS licence.

No.	Health status	GCAS licence requirement
1	Lowest correlation (R^2) of last calibration	None
2	Uncertainty of calorific value	*Uncertainty Calculation*
3	Uncertainty of molecular weight composition	*Uncertainty Calculation*
4	Uncertainty of Wobbe index	*Uncertainty Calculation*
5	Uncertainty of relative density (specific gravity)	*Uncertainty Calculation*
6	Uncertainty of standard density	*Uncertainty Calculation*
7	Date of last calibration record	None
8	Date of last mole composition record	*Live Data Analysis*

Click an item and click **Show** to display the health status on the dashboard tile. Dashboard tiles hold maximum 4 items as laid out in list box on the right. Click an item on the right-hand list and click **Hide** to remove this health status out of dashboard tiles. The list box on the right also determines the

order/sequence of displayed health statuses. Reorder the items through **Move up** or **Move down** button.

16.1.1.1 Lowest correlation (R^2) of last calibration

Depending on the device type, the table below summarises how the lowest R^2 is determined.

Device type	Lowest R^2 is the lowest among these R^2 values		
Daniel C6+	C1-C2-C6	C3-C4-C5	
Daniel C7+	C1-C2-C7	C3-C4-C5-C6	
Daniel C9+	C3-C4-C5	C6-C7-C8-C9	
Daniel C10+	C3-C4-C5-C6	C7-C8-C9-C10	
ABB C6+	C3-C4-C5	C4-C5-C6	C3-C4-C5-C6
ABB C7+	C3-C4-C5-C6	C4-C5-C6-C7	C3-C4-C5-C6-C7

Notice that lowest R^2 for Daniel C6+ and C7+ devices is determined only by first two correlations. The third correlation (C1-C2-C3-C4-C5-C6 or C1-C2-C3-C4-C5-C6-C7) is ignored. If the lowest R^2 falls below the R^2 threshold defined in the Analysis Parameter of a device (typically 0.995), the tile for that device turns red.

16.1.1.2 Uncertainties

There are five uncertainty health statuses to display. Uncertainty of calorific value (CV) is probably the most used among the others. The calculation uses these inputs:

- **Calibration certificate**: Configurable through uncertainty calculation settings tab. If a device doesn't have any calibration certificates, GCAS Desktop aborts uncertainty calculation for this device, uncertainty health status on its dashboard tile turns grey, and displays "`no certificate`".
- **Uncertainty coefficients**: This always follows last uncertainty calculation configuration. If last configuration is not available, GCAS Desktop tries to find the latest coefficient set. If no coefficient sets are available, $U_{repeatability}$ is not included in the uncertainty calculation.
- **Mole percentage range**: This always follows last uncertainty calculation configuration. If last configuration is not available, GCAS Desktop assumes a range of ±20% universal.
- **Footprint**: Configurable through uncertainty calculation settings tab with fallback/default to use latest footprint. If a device doesn't have any footprints, $U_{reproducibility}$ is not included in the uncertainty calculation.
- **Calibration data**: Configurable through uncertainty calculation settings tab with fallback/default to all calibration records from the footprint to today.
- **ISO 6976 calculation**: This always follows last uncertainty calculation configuration. If last configuration is not available, GCAS Desktop assumes base pressure of 1 atmosphere (101,325 Pa), combustion temperature 0°C and metering temperature 0°C.

Last uncertainty calculation configuration is the configuration on the input pages the last time you opened Uncertainty Calculator form. Each device has its own last uncertainty configuration.

Complete uncertainty calculation—all three $U_{cal\ gas}$, $U_{repeatability}$, and $U_{reproducibility}$ are present—is indicated by no asterisk symbol on dashboard tile. Incomplete uncertainty calculation has asterisk symbol on it. For example, the dashboard tile displays `U(CV)* = 0.1206%`.

By default, dashboard tiles turn red if their combined expanded uncertainty exceeds 0.2%. You can change this threshold or the uncertainty type (absolute or combined expanded) at the rules tab.

16.1.1.3 Date of last calibration

Date of last calibration record indicates how long time has passed since GC was last calibrated. On dashboard tiles, date of last calibration has  calibration data icon. If last calibration was marked as footprint, it has  footprint icon.

By default, the dashboard tile should've turned red if date of last calibration is older than 3 days. However due to various calibration policy among groups or platforms, this rule is turned off. To change the threshold (i.e. how many days to make it red) and turn on the rule, go to rules tab. Furthermore you can override the rule for date of last calibration at per-workspace and per-device level. Visit chapter 16.2 Overriding Rules for more information.

16.1.1.4 Date of last mole composition

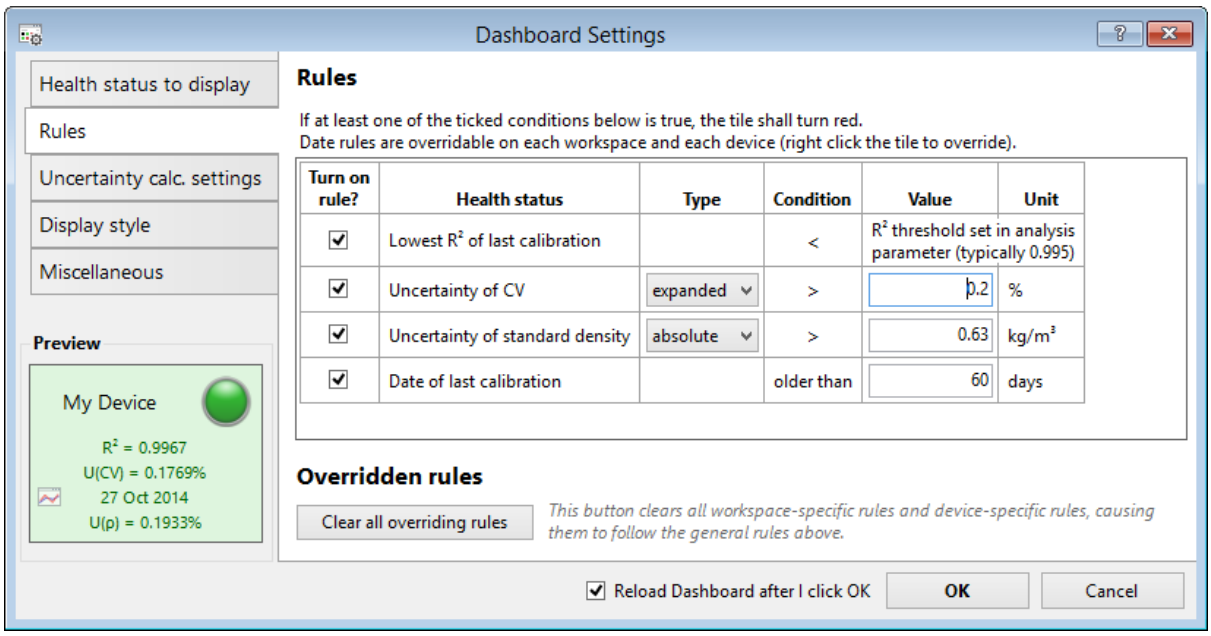
Date of last mole composition shows the timestamp of latest mole composition record (among all streams). On dashboard tiles, date of last mole composition has  mole composition icon.

Date of last mole composition is useful to monitor the connectivity between your GC device and GCAS Desktop running in another computer next to the GC device. Should a problem occurred and the data capture terminated, mole composition records stop coming and you notice the timestamp of last mole composition record is stationary after several dashboard refreshes.

Default setting dictates that dashboard tiles should turn red if date of last mole composition record is older than three hours. You can change the threshold, the time unit (minutes, hours, days), or turn off the rule at the rules tab. Do not put unrealistic threshold for instance, 1 minute, because mole composition records usually come every 4~7 minutes. Specifying the threshold to a value lower than GC cycle time will cause the dashboard tile to become everlasting red.

Rules for date of last mole composition is also overridable at per-workspace and per-device level. Visit chapter 16.2 Overriding Rules for more information.

16.1.2 Rules



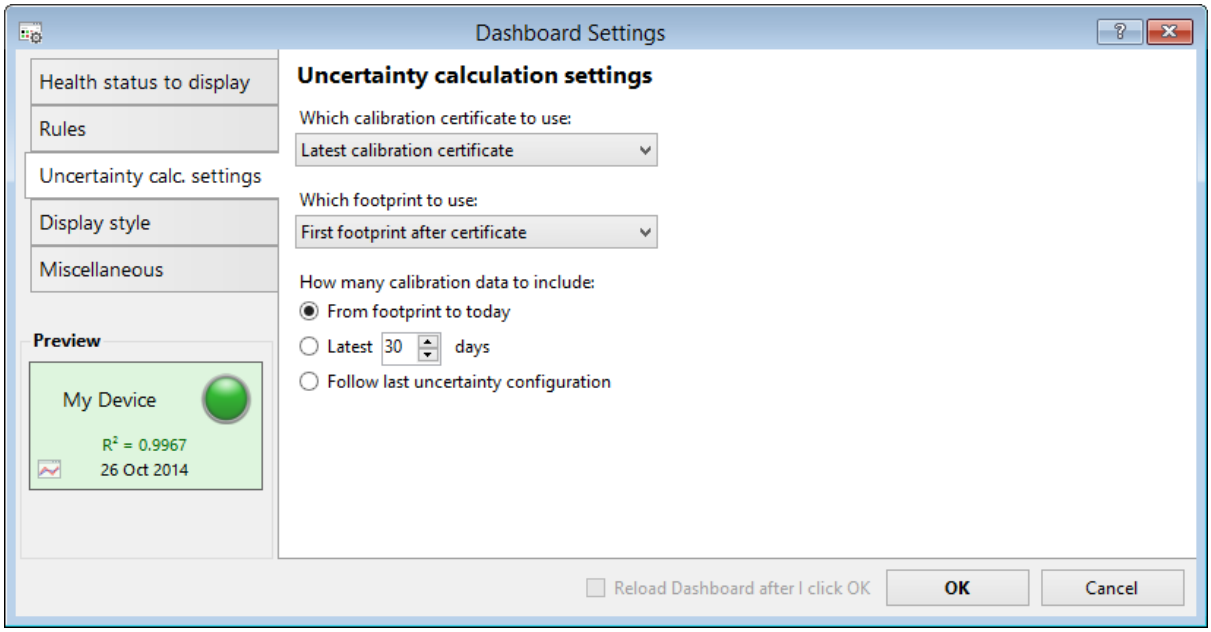
Simply put, *rules* are definitions of conditions causing a dashboard tile to become red. Every GC health status displayed on dashboard tiles has its own rules to define above what value or below what value the health status should make the dashboard tile red. For example, uncertainty of CV has a rule that if a device has combined expanded CV uncertainty more than 0.2%, it is unhealthy.

Rules can be turned on or off. When a rule is turned off, it doesn't affect the decision whether the dashboard tile should become green or red. For example, a user decided to display three health status: lowest R^2, uncertainty of CV, and date of last calibration. The rule for R^2 is turned on, rule for uncertainty of CV is turned on, but the rule for date of last calibration is turned off. After next refresh, it turned out that minimum R^2 is 0.9974, combined expanded uncertainty of CV is 0.1250%, and date of last calibration is seven days ago. Rule for R^2 makes the tile green, rule for U(CV) makes the tile green, but the rule for date of last calibration makes the tile red. We expect the tile to become red by now. However as the rule for date of last calibration was turned off, the tile is only affected by the rule of R^2 and U(CV). Green meets green becomes green, hence the tile stays green. To turn off a rule, uncheck the corresponding check box on this tab.

- Rule for lowest R^2 (correlation) is the most simple rule of all: if a device has lowest R^2 below the threshold defined in its Analysis Parameter, it is unhealthy.
- Rules for uncertainty has two configurable fields: the uncertainty type (absolute or combined expanded), and the threshold value. Absolute uncertainty changes the unit to the absolute unit such as MJ/m^3 for uncertainty of CV, while expanded uncertainty changes the unit to percentage.
- Rules for date of last calibration has one configurable field, which is how many days to make the tile red. This field accepts decimal number. For example, 3.25 days means 3 days and 6 hours.
- Rules for date of last mole composition has two fields, the threshold limit and its time unit. This field accepts decimal number too.

Date rules, consisting of rule for date of last calibration and rule for date of last mole composition record, are overridable. More information about overriding a rule is on chapter 16.2. To delete all overriding rules in one go, click **Clear all overriding rules** on this tab.

16.1.3 Uncertainty Calculation Settings



This tab configures several inputs used by uncertainty calculation of all devices. If your GCAS licence doesn't include *Uncertainty Calculation*, this tab only displays a text `your GCAS licence does not include uncertainty calculation`.

Some uncertainty calculation inputs always follow last uncertainty configuration, like uncertainty coefficients and ISO 6976 settings. *Last uncertainty configuration* is the configuration you have set on the input pages the last time you opened Uncertainty Calculation form. Every device has its own last uncertainty configuration.

Which calibration certificate to use: Choose whether to use latest certificate of each device, or to follow last uncertainty configuration of each device.

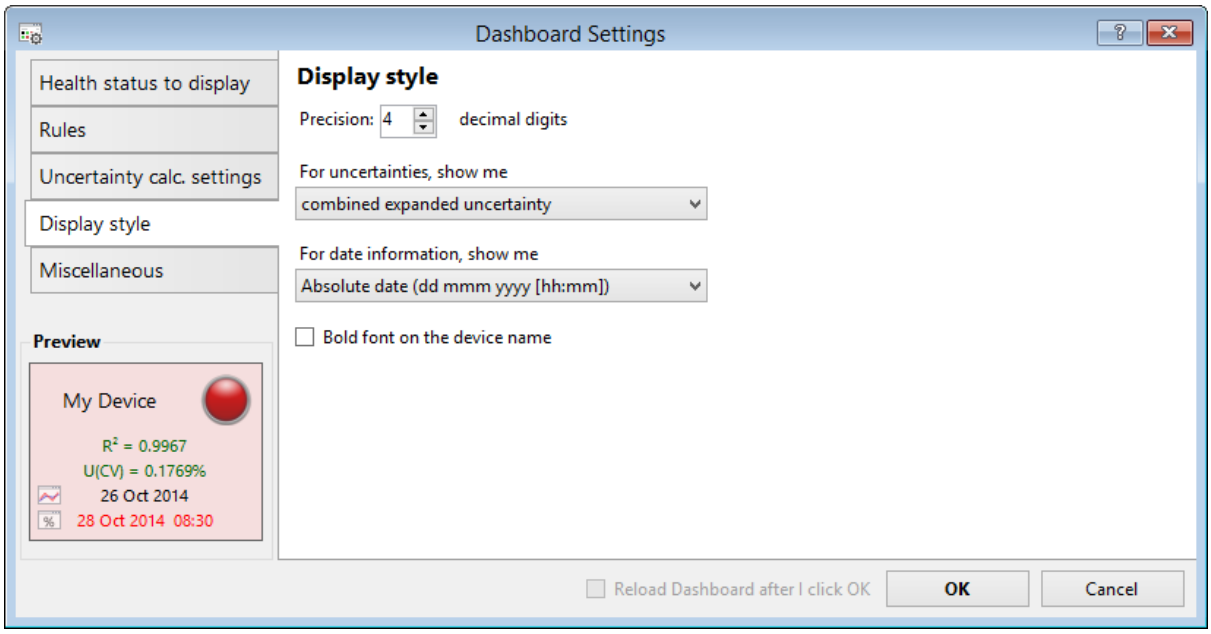
Which footprint to use: There are three choices. Use latest footprint, use first footprint found after the certificate timestamp, or follow last uncertainty configuration. If you selected first footprint after certificate but there are no actual footprints after certificate timestamp, GCAS Desktop falls back to the latest footprint. If a device doesn't have any footprints, $U_{reproducibility}$ won't be included in the uncertainty calculation and uncertainty health statuses shall bear an asterisk symbol on them.

How many calibration data to include: Pick one of the choices.

- *From footprint to today* (the default) takes the footprint itself, all calibration data afterwards, all subsequent footprints, and all subsequent calibration data after them, all the way until current computer time.

- *Latest* x *days* (default *x* = 30) takes all calibration data counted down from today to today minus *x* days. Nevertheless if GCAS Desktop bumps into a footprint within these *x* days, GCAS Desktop stop travelling backward and instead takes that footprint plus all calibration data until today.
- *Follow last uncertainty configuration* causes GCAS Desktop to follow last uncertainty configuration of each device—including custom calibration data range if you have set them through Uncertainty Calculator form beforehand.

16.1.4 Display Style



Display style tab configures the appearance of dashboard tiles.

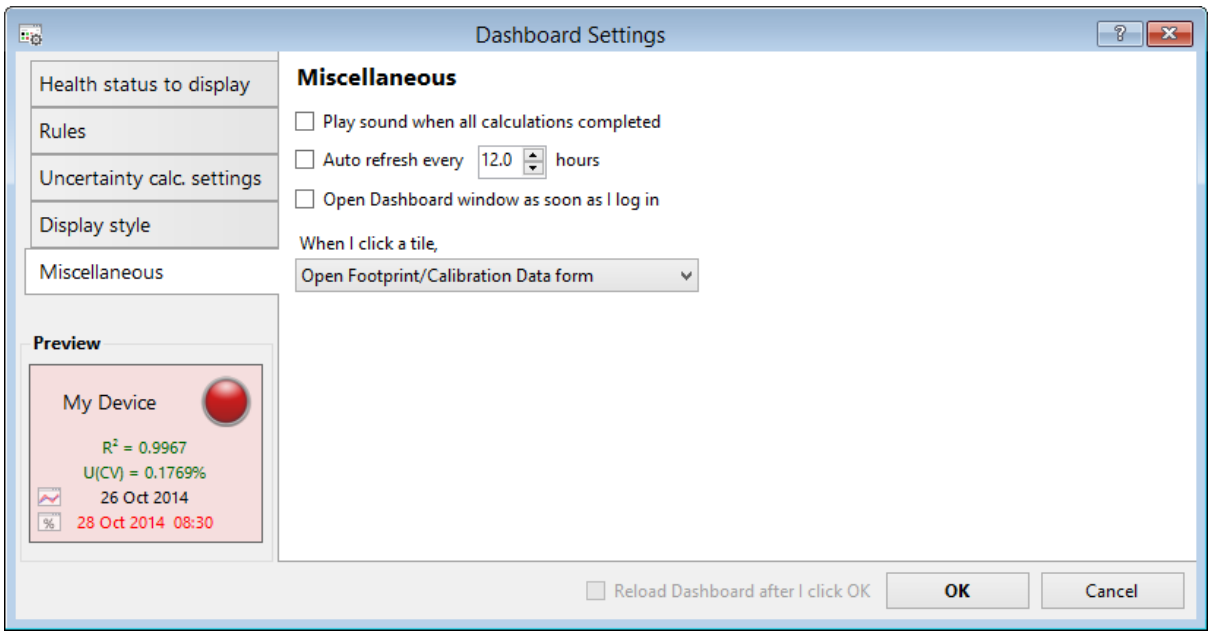
Precision: Select how many decimal digits to display on numeric health status (lowest R^2 and uncertainties). The default precision is 4 digits. However if you opt to show both types of uncertainties (i.e. expanded and absolute), GCAS Desktop can only display 2 digits.

For uncertainties, show me: Select which type of uncertainties to display. This setting applies to uncertainty health statuses. Most users prefer combined expanded uncertainty (expressed in percentage) over absolute uncertainty (expressed in units such as MJ/m^3 for CV). There is also a choice to display both, however GCAS Desktop can only fit 2 decimal digits due to space limitation.

For date information, show me: Select date format to display. This setting applies to date of last calibration and date of last mole composition record. The default is absolute date which shows the exact date-month-year (and also hour-minutes for last mole composition record). The other choice is rough relative timespan like "3 days ago" or "5 hours ago".

Bold font on the device name makes the device tag name on dashboard tiles use bold face. Look at the preview tile at the left side of this dialogue box to see if you fancy the bold font.

16.1.5 Miscellaneous



The misc tab configures other behaviours which are not categorised into the other four tabs.

Play sound when all calculations completed makes GCAS Desktop play a ding sound after all calculations completed. On slow connection, a dashboard refresh may take minutes to complete so GCAS Desktop can notify you that dashboard refresh is finished.

Auto refresh causes the Dashboard form to refresh itself once every the defined interval. The default is 12 hours, but you can change it between half an hour (30 minutes) and 72 hours (3 days). By default, auto-refresh is turned off. If you turn auto-refresh on and leave Dashboard open for a long time, we recommend to turn off automatic logout on inactivity.

Open Dashboard window as soon as I log in instructs GCAS Desktop to open Dashboard immediately after all workspaces and devices have been loaded. This only works after GCAS login, not after changing database or refreshing device panel.

When I click a tile, select the action you want GCAS Desktop to do. There are four options.

- **Do nothing**.
- **Open Footprint/Calibration Data form**: This action opens the footprint or calibration record who has the lowest R^2 displayed on the dashboard tile.
- **Open Mole Composition form**: This action opens the latest mole composition record, assuming that the date of latest mole composition record is displayed on the dashboard tile. If your GCAS licence doesn't have *Live Data Analysis*, this option is not available.
- **Open Uncertainty Calculator form**: This action opens Uncertainty Calculator form for the device represented by the dashboard tile, but that's it. The settings at the Uncertainty Calculator form may be different from the settings defined by the uncertainty calculation settings tab, hence may produce different uncertainty values. Both dashboard tile and the Uncertainty Calculator form should produce the same values if everything on uncertainty

settings tab was set to "follow last uncertainty configuration". If your GCAS licence doesn't have *Uncertainty Calculation* feature, this option is not available.

16.2 Overriding Rules

Rules for date of last calibration and date of last mole composition record are overridable at device level or workspace level. Rules for R^2 and uncertainty are not, however. Overriding at *device level* causes the dashboard tile of this device to ignore the general date rules and use the overridden date rules instead. Overriding at *workspace level* causes all dashboard tiles under this workspace to use the overridden date rules.

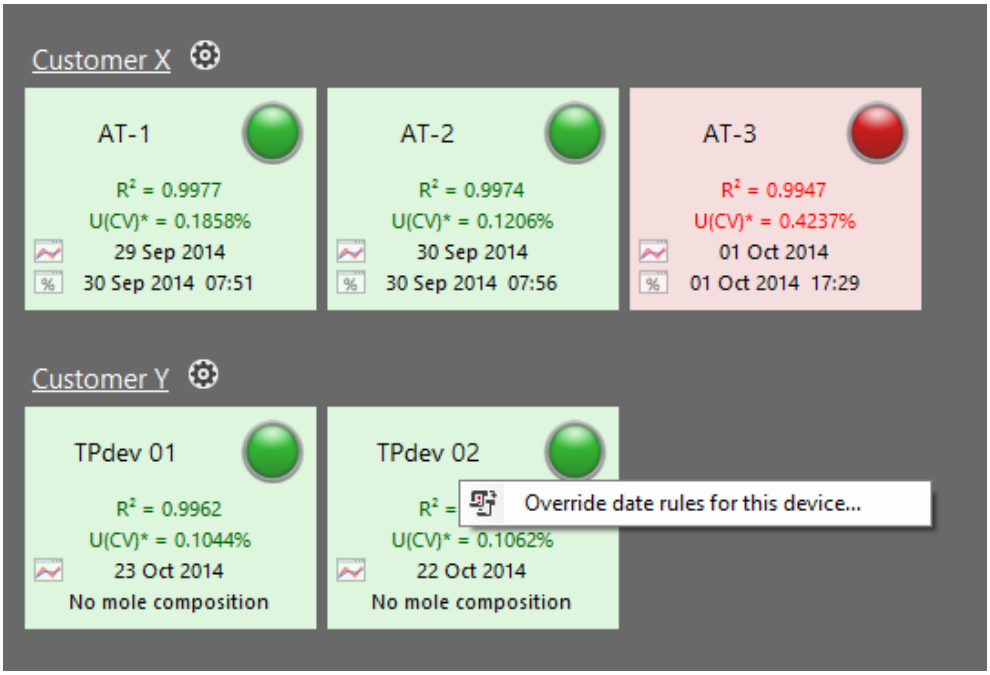
For example, you have set the general rule for date of last calibration stating all devices who were calibrated past 3 days ago shall be red. However, there's this one platform called Workspace X which enforces a different calibration policy, for instance, once every 7 days. This causes the dashboard tiles under Workspace X to become red if their last calibration date is, let's say, 5 days ago. By overriding calibration date rule for Workspace X, we can specify that all devices under Workspace X uses 7-day rule, not three.

Device-specific override has priority over workspace-specific override. For instance, Workspace X has five GC devices named X1, X2, X3, X4, and X5. These five devices were calibrated 9 days ago. Your general rule state 3-day calibration rule, but those under Workspace X are overridden to use 7-day calibration rule. Now let's override the date rule for device X4 to be 14 days. As a result, device X1, X2, X3, and X5 become red while device X4 is still green.

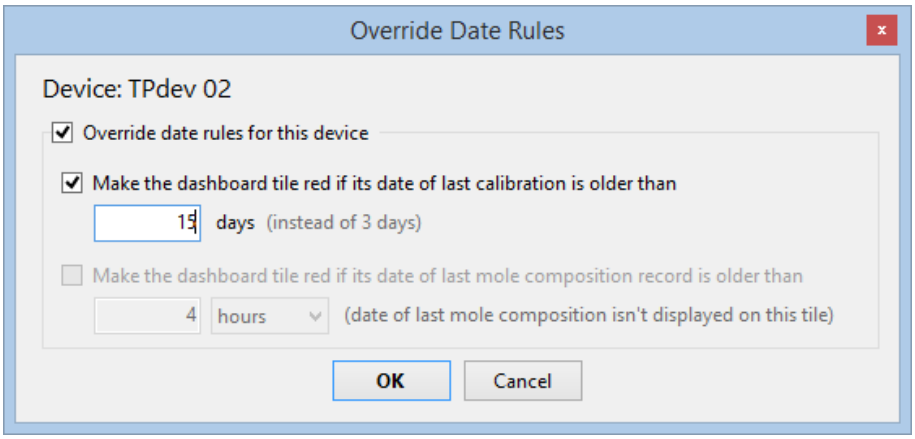
You can even override the on/off status of a date rule. For example, the general rule for last calibration date is turned on, but this particular device is overridden as turned-off. You shall see other devices have green or red font on their dashboard tiles, while this device has black text for its last calibration date. The same applies for the other way round, if the general rule is turned off but you wish to turn on date rules for several devices or workspaces.

16.2.1 Per-Device Override

To override date rules at device level, right click the dashboard tile.



The menu brings us to the *Override Date Rules* dialogue box.


Override Date Rules
Device: TPdev 02
Override date rules for this device
Make the dashboard tile red if its date of last calibration is older than
15 days (instead of 3 days)
Make the dashboard tile red if its date of last mole composition record is older than
4 hours (date of last mole composition isn't displayed on this tile)
OK
Cancel

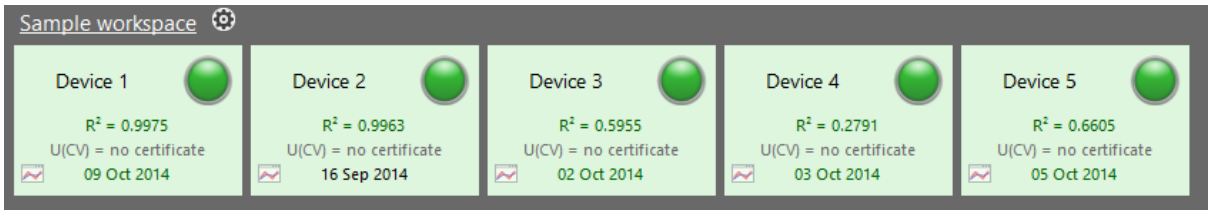
Tick **Override date rules for this device**. This is the *main device override switch* for this device. If you remove this tick, you are effectively revoking its override—causing the device to fall one level down (per-workspace override) if defined, or return to the general rules already set at the rules tab.

Inside the frame there are two check boxes. One is for date of last calibration, the other is for date of last mole composition. These check boxes control the on/off status of the overriding rules. In the screenshot above, the check box for date of last mole composition record is greyed out because date of last mole composition is not displayed on the dashboard tile. (Screenshot for illustrational purpose only.)

Set the new threshold value for this device. For example, let's use 15 days as in the screenshot above.

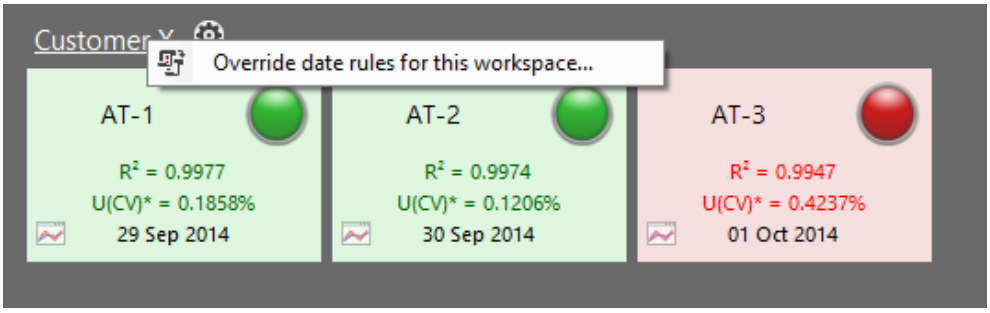
Main device override switch	*General rule active?*	*General rule threshold*	*Device override active?*	*Device override threshold*	*Result: Dashboard tile becomes red if last calibration is older than*
ON	Don't care	3 days	**ON**	**15 days**	**15 days**
ON	Don't care	3 days	OFF	15 days	Rule is turned off
OFF	**ON**	**3 days**	Don't care	15 days	**3 days**
OFF	OFF	3 days	Don't care	15 days	Rule is turned off

Click **OK** to close the dialogue box and you shall see the Dashboard applies your new rules. For example, we overrode Device 2 to turn off its calibration date rule in the screenshot below.

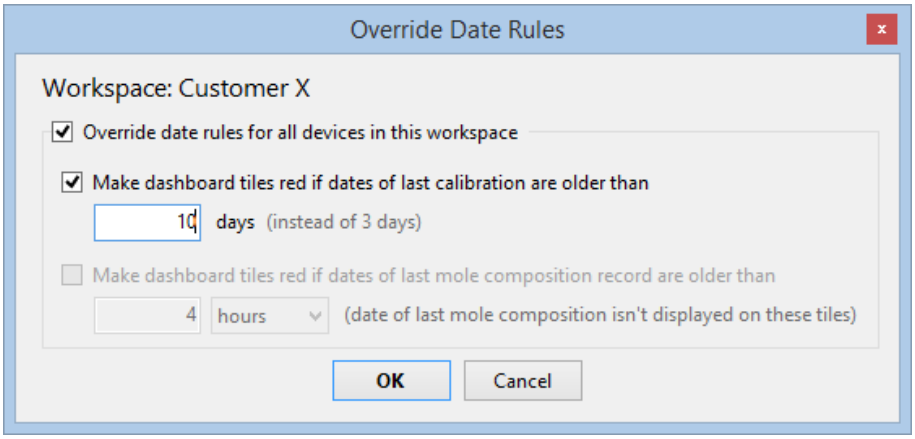


16.2.2 Per-Workspace Override

To override date rules at workspace level, right click the heading text or click the ⚙ gear icon.



This also brings the *Override Date Rules* dialoge box. However this time, it applies to all devices within this workspace.


Override Date Rules
Workspace: Customer X
Override date rules for all devices in this workspace
Make dashboard tiles red if dates of last calibration are older than
10 days (instead of 3 days)
Make dashboard tiles red if dates of last mole composition record are older than
4 hours (date of last mole composition isn't displayed on these tiles)
OK
Cancel

Tick **Override date rules for all devices in this workspace**. Similarly, this is the *main workspace override switch*. The two check boxes operate at similar fashion as per-device override. Nonetheless be reminded that device-specific overrides take priority over workspace-specific overrides.

Main workspace override switch	Main device override switch (<!> takes priority)	General rule active?	General rule threshold	Workspace override active?	Workspace override threshold	Device override active?	Device override threshold	Result: Dashboard tile turns red if date of last calibration is older than
ON	**ON<!>**	DC	3 days	DC	10 days	**ON**	**15 days**	**15 days**
ON	**ON<!>**	DC	3 days	DC	10 days	OFF	15 days	Rule is turned off
ON	OFF	DC	3 days	**ON**	**10 days**	DC	15 days	**10 days**
ON	OFF	DC	3 days	OFF	10 days	DC	15 days	Rule is turned off
OFF	**ON**	DC	3 days	DC	10 days	**ON**	**15 days**	**15 days**
OFF	**ON**	DC	3 days	DC	10 days	OFF	15 days	Rule is turned off
OFF	OFF	**ON**	**3 days**	DC	10 days	DC	15 days	**3 days**
OFF	OFF	OFF	3 days	DC	10 days	DC	15 days	Rule is turned off

DC = don't care.

16.2.3 Revoking (Cancelling) an Override

Revoking an override causes the device (or all devices in a workspace) to return to the general rules defined at the rules tab.

To revoke device-specific overriding rules, bring the *Override Date Rules* dialogue and untick **Override date rules for this device**. Click **OK** to commit the change and the Dashboard window shall update itself.

To revoke workspace-specific overriding rules, bring the *Override Date Rules* dialogue and untick **Override date rules for all devices in this workspace**. Click **OK** to commit the change.

To revoke all device-specific and workspace-specific overrides, open Dashboard Settings then go to the rules tab. Click **Clear all overriding rules** button at the bottom and finally finish it by clicking **OK**.

17 Mole Composition Comparison

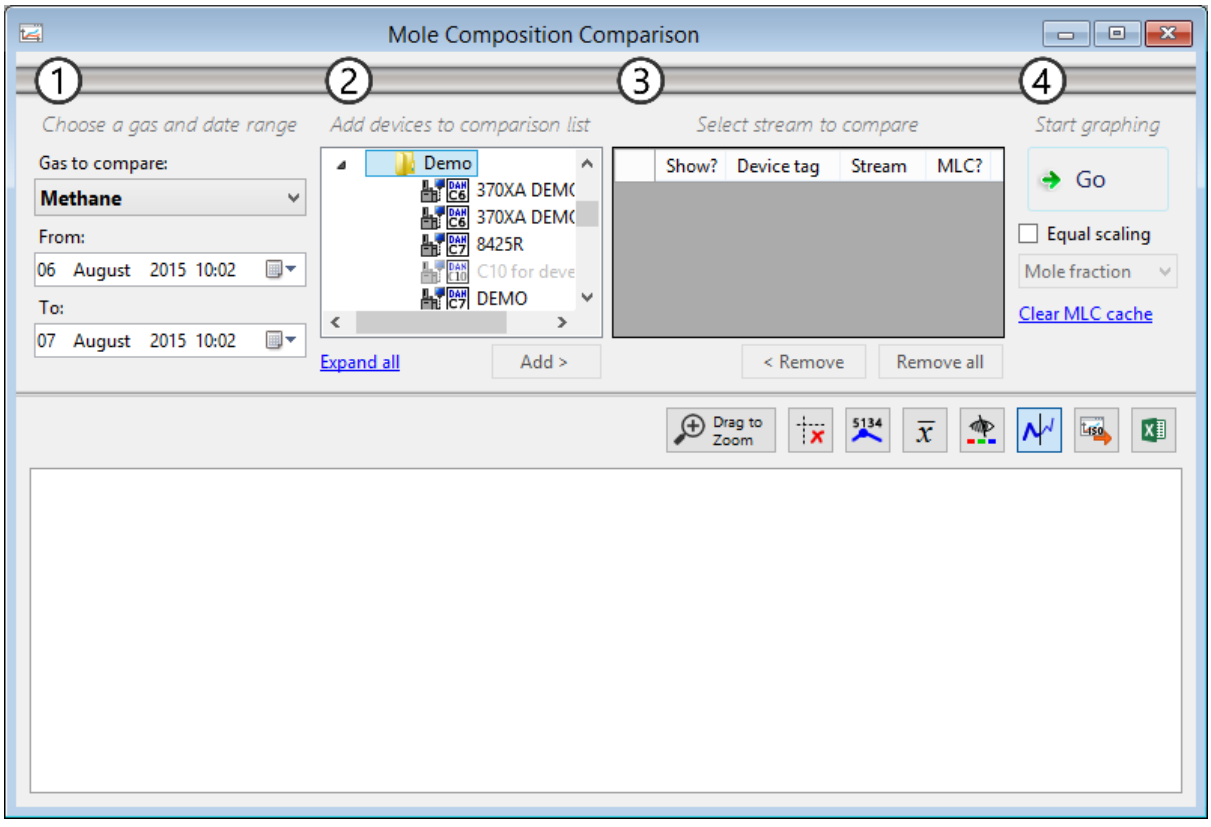
Mole Composition Comparison is a tool to compare trends of mole composition across different devices. This module complements the Data Analysis module. Through Data Analysis you see mole composition trend of various gases for one device, now on Mole Composition Comparison you see mole composition trend of one gas for various devices.

Note

This module requires two GCAS features to be included in your GCAS licence: *Live Data Analysis* and *Data Comparison*.

17.1 The *Mole Composition Comparison* Form

To open Mole Composition Comparison form, go to the Tools menu > **Mole Composition Comparison**.

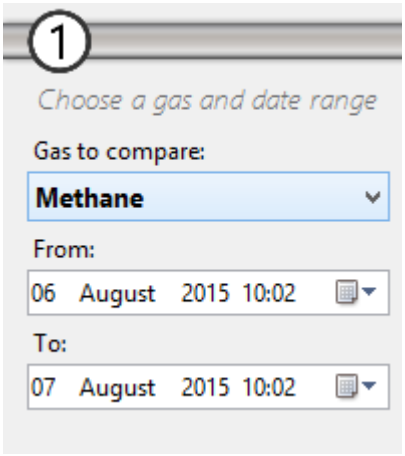


Mole Composition Comparison form has two resizable sections. Parameters and device list are at the top, while the comparison chart is at the bottom.

17.2 Parameters and Device List

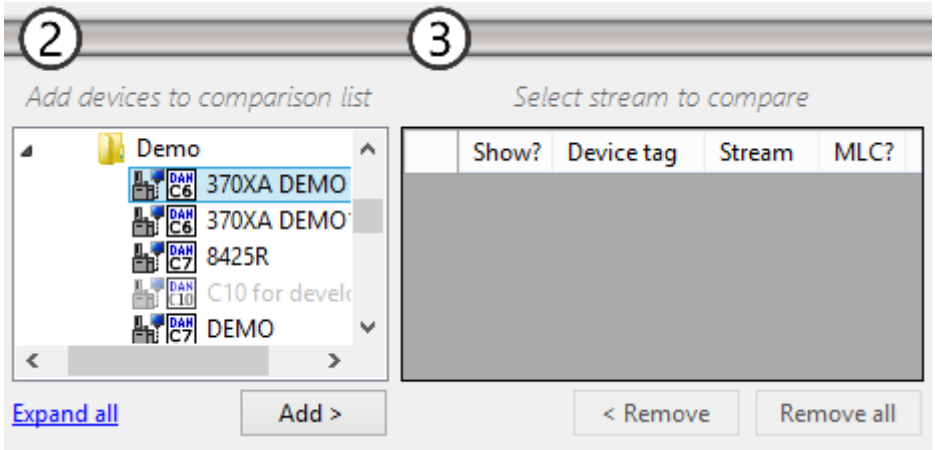
The top section of the form has a linear flow. Select the gas and comparison date range (under section ❶), browse the devices to compare (❷) and add them to the comparison list (❸), select which stream of these devices (❸) and finally click **Go** (❹) to start graphing.

17.2.1 Gas and Date Range



GCAS Desktop supports 15 gases to compare across different devices. This dropdown also includes neopentane and higher alkanes such as heptane, octane, nonane, and decane. Please note that not all devices have a complete range of gases, for some do not have neopentane and some others do not have heptane and higher. When you set the gas octane to compare then tick a device which doesn't include octane for example, its line will lie on the X-axis because its Y-values are all zeroes.

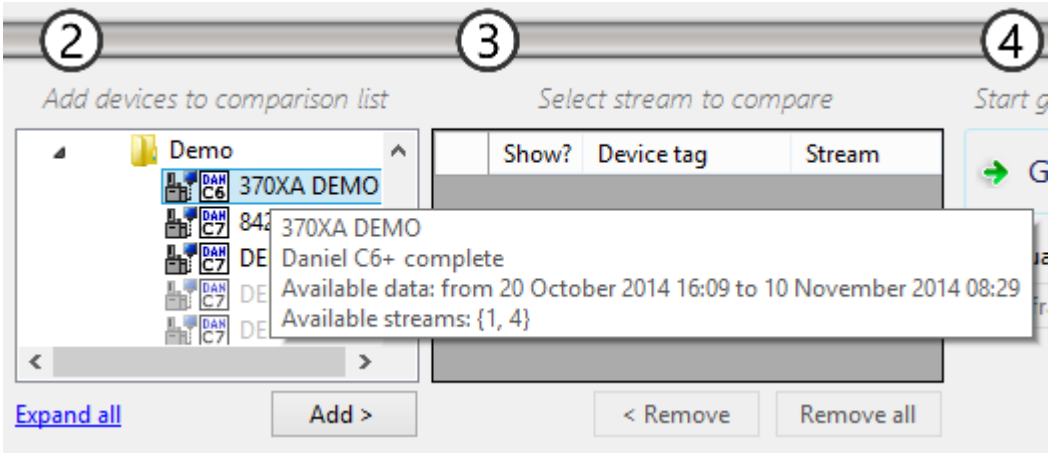
17.2.2 Devices and Comparison List



On the left you see the *device tree view*. It lists all your workspaces and devices within each workspace. The grid on the right is known as *comparison list*.

Hover your mouse pointer over a device to view more information about data availability and stream numbers. In the screenshot below, the device 370XA DEMO has stream 1 and stream 4. Devices which

don't have mole composition records at all are displayed as semi-transparent and cannot be added to the comparison list.

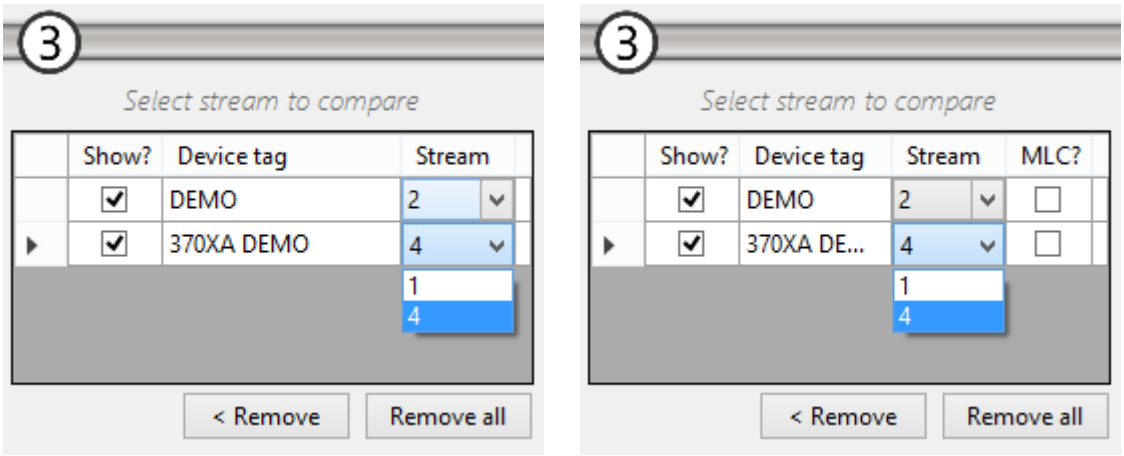


To compare devices, add the devices from the device tree view to the comparison list. Either select the device then click **Add**, or double click the device, or drag the device and drop it onto comparison list.

Note

A Mole Composition Comparison form which was opened through *Send to* shortcut from Data Analysis' *Send to Mole Composition Comparison* menu or *Compare both* link, is locked to one particular device and one particular stream number. Device tree view is empty and you cannot add another device into comparison list. The text above the chart should clearly indicate the form is locked. Click **Reset and reload device list** next to this text in order to unlock Mole Composition Comparison form back into normal mode.

Once the device has been added to the comparison list, select the stream number to compare. You can compare different streams of the same device too. To do so, add the device to the comparison list twice, then select different stream number for each of them. Moreover if you have *ISO 10723* feature in your GCAS licence which we will explain very soon, this tool can also compare the single-point composition vs. multilevel-calibrated composition of the same device, same stream number.



Example of comparison list for users without ISO 10723 (left) and with ISO 10723 (right).

The column **Show?** contains check boxes which is used to hide or show the line chart of corresponding comparison entry after the chart has been rendered completely.

Users having GCAS feature *ISO 10723* in their GCAS licences see an additional column named **MLC?** which also contains check boxes. This is the single-point/MLC switch. Tick the check box to graph multilevel-calibrated composition, otherwise leave it unticked to graph single-point composition.

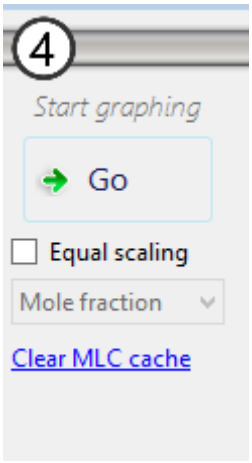
To remove an entry from the comparison list, highlight its row on the grid and then click **Remove** or press `Delete` on your keyboard. Everytime a comparison entry is removed from the comparison list, its line chart is also removed. However if you add it back, you need to redraw the chart because its data in the cache has already gone. This is the difference between removing an entry versus temporarily hiding it (by unticking the check box inside the **Show?** column). In addition, click **Remove all** to empty the comparison list and start over.

Note

Maximum number of entries in comparison list is 15 entries.

GCAS Desktop will alert you if there are duplicate comparison entries. A *duplicate* means same GC device + same stream number [+ same MLC/single-point switch if you have *ISO 10723*].

17.2.3 Start Graphing



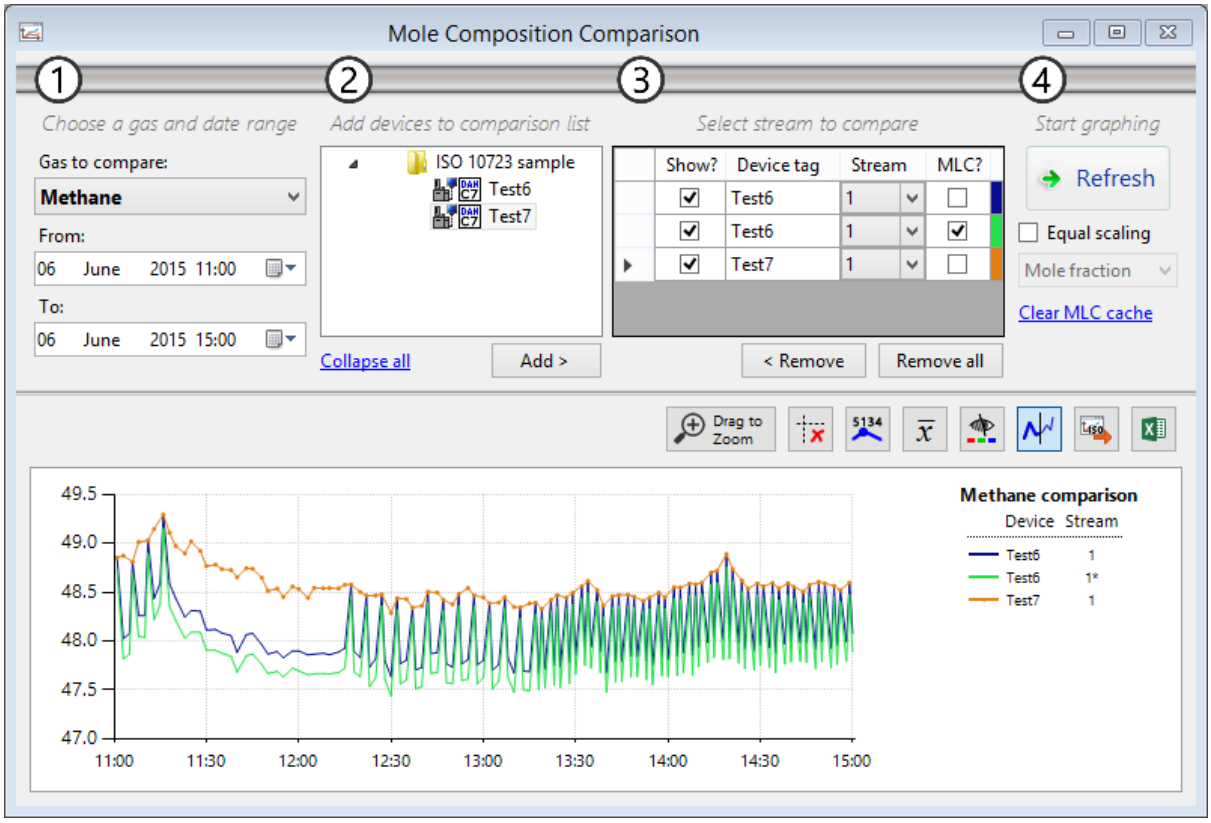
When everything else are correct, simply click **Go**. GCAS Desktop loads the required mole composition data and renders the chart. The **Go** button turns into **Refresh** button unless you change the selected gas, comparison date range, devices, stream numbers, or single-point/MLC switch.

Equal scaling, if ticked, forces all comparison entries to use the same normalisation scale. Tick this option if you are comparing multiple devices having different scales, such as this GC uses *fraction* and that GC uses *percentage*. More about scaling equalisation on chapter 17.3.2.

Users with *ISO 10723* feature in their licences see an additional command link **Clear MLC cache**. This clears the cache used by ISO 10723 conversion. The cache contains MLC coefficients, calibration

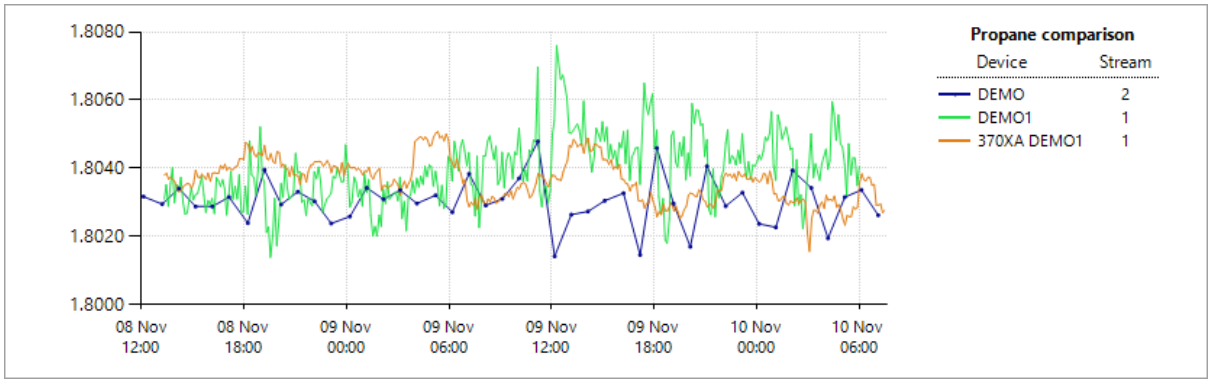
certificates, single-point RF, MLC RF, and MLC constraints. Click this link if you notice the multilevel-calibrated streams are graphed incorrectly. Once the MLC cache is emptied, refresh the chart.

The chart legend lists the device tag name and the stream numbers. Multilevel-calibrated streams are indicated with asterisk (*) after stream number similar to the green line in this screenshot example.



17.3 Comparison Chart

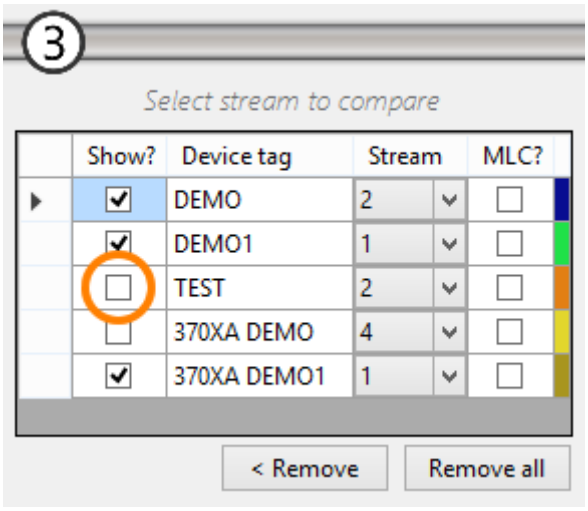
The chart graphs the historical mole composition of the selected gas over time, limited by your plot range, device, stream number (and single-point or MLC selection for ISO 10723) at a time. This chart has maximum capacity of 15 comparison entries. The legend at right side tells what gas it is, the devices, and their stream numbers. Multilevel-calibrated streams (ISO 10723) are indicated with asterisk (*) after their stream numbers.



By default, GCAS Desktop draws the chart using thin lines, unlike all other charts in GCAS Desktop which use 2-pixel width. Line charts having data points less than 100 have small dot markers along its body. Line charts with more than 100 dots are presented without markers.

17.3.1 Show or Hide Some Devices

Untick the checkbox at the column **Show?** inside the comparison list to temporarily hide a device (a line) on the chart. Check the checkbox to bring the line visible.



If you *remove* a device from this list, its line chart is also removed. After you add the device back, you need a full refresh to redraw the lost line.

17.3.2 Scaling Equalisation

GCAS Desktop stores mole composition records as-they-are in the database. There is no information about its *scale* stored in database. Most devices use *percentage scale* (0 to 100). Some others output *fraction scale* (0 to 1). GCAS Desktop determines scaling by the unnormalised total. For example if the unnormalised sum is near 1, the device uses fraction scale. If the sum is near 100, it is percentage. If near 1000, it is permillage (‰).

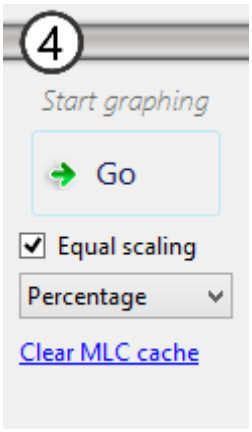
GCAS Desktop supports fraction scale (0 to 1) up to PPB scale (0 to 1,000,000,000) officially. This becomes a problem in mole composition comparison: What happens when you compare device A with percentage scale and device B with fraction scale?

The answer, GCAS Desktop plots mole composition records as they are. The two line charts will appear far apart as device A has methane composition about 70 (percentage scale) while device B has around 0.7 (fraction scale). Thus the line chart of device A flies high up there while device B lies low near the X-axis.

To circumvent this problem, Mole Comparison Composition form is equipped with *scaling equalisation*. However it is not enabled by default. The reason is most users have all GC devices

generating mole composition records on the same scale, or at least *configured* to output on the same scale. Therefore scaling problems rarely affect GCAS users.

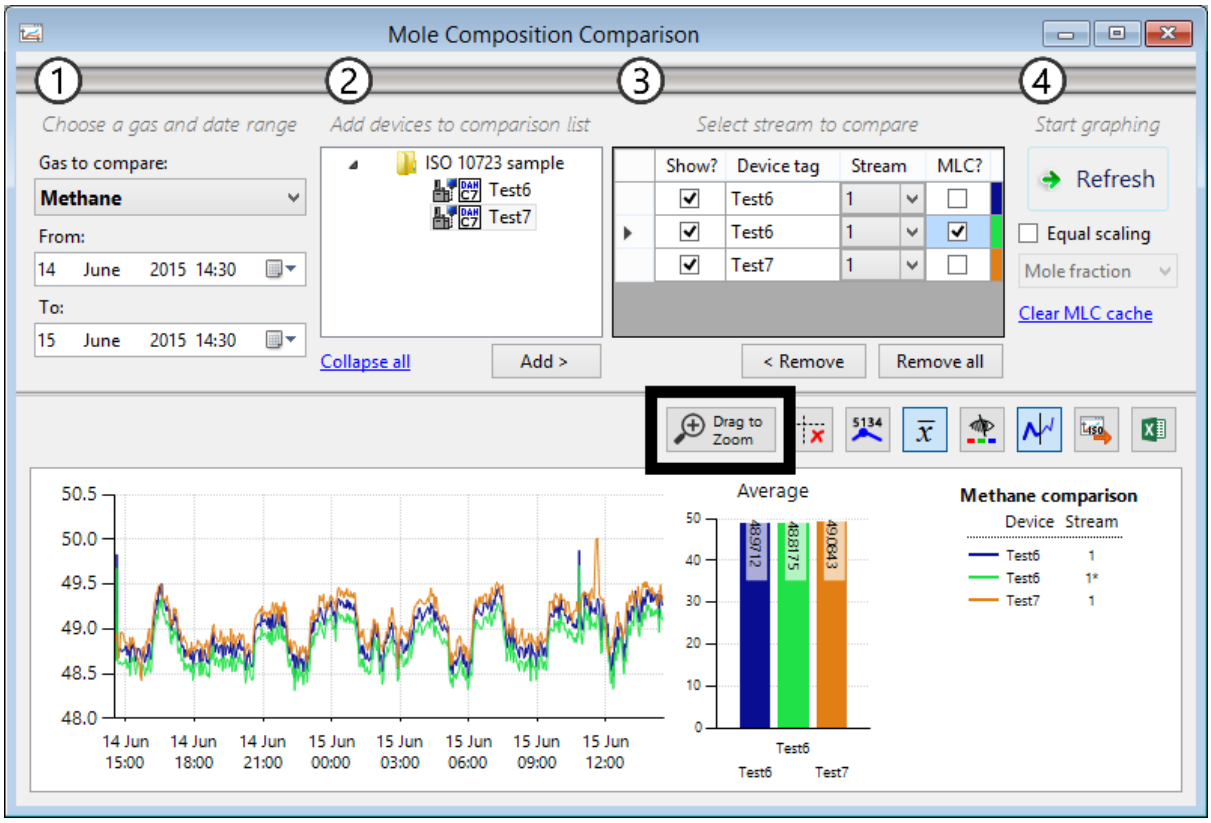
If you *do* compare devices with different scaling, be sure to tick **Equal scaling** before you click **Go**. Select one of four available scales: fraction, percentage, permillage, or parts-per-million (PPM).



Continuing our example about device A and B, with *mole fraction* scaling equalisation, you are downscaling device A to fraction (0 to 1) while device B remains in fraction scale. If you select *percentage* on this dropdown, you are upscaling device B to percentage (0 to 100) instead.

17.3.3 Zoom Mode and Selection Mode

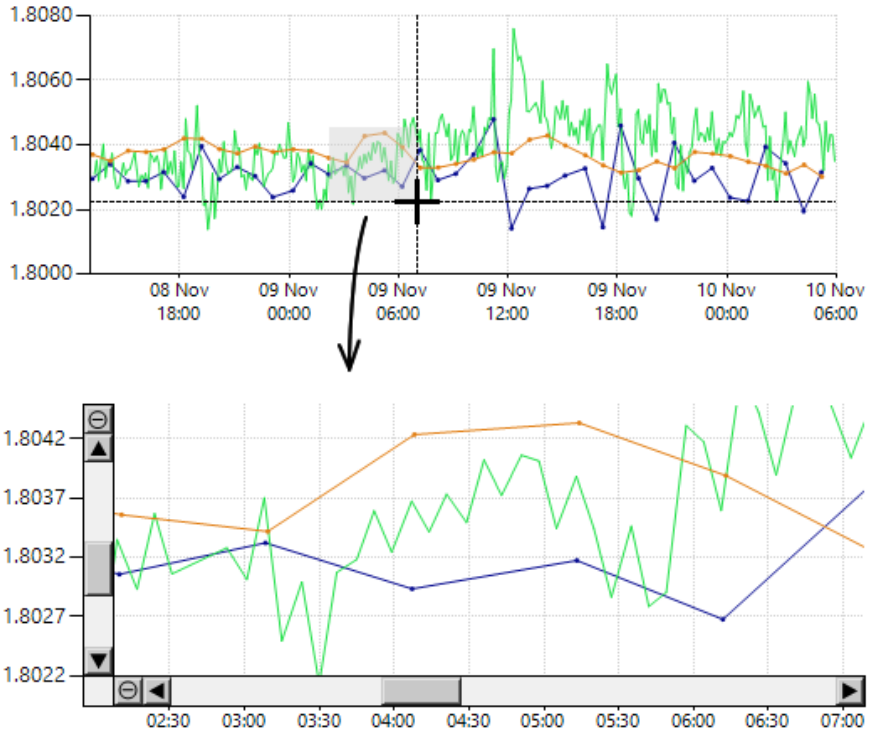
This toggle button controls whether the comparison chart is in *zoom mode* or *selection mode*.



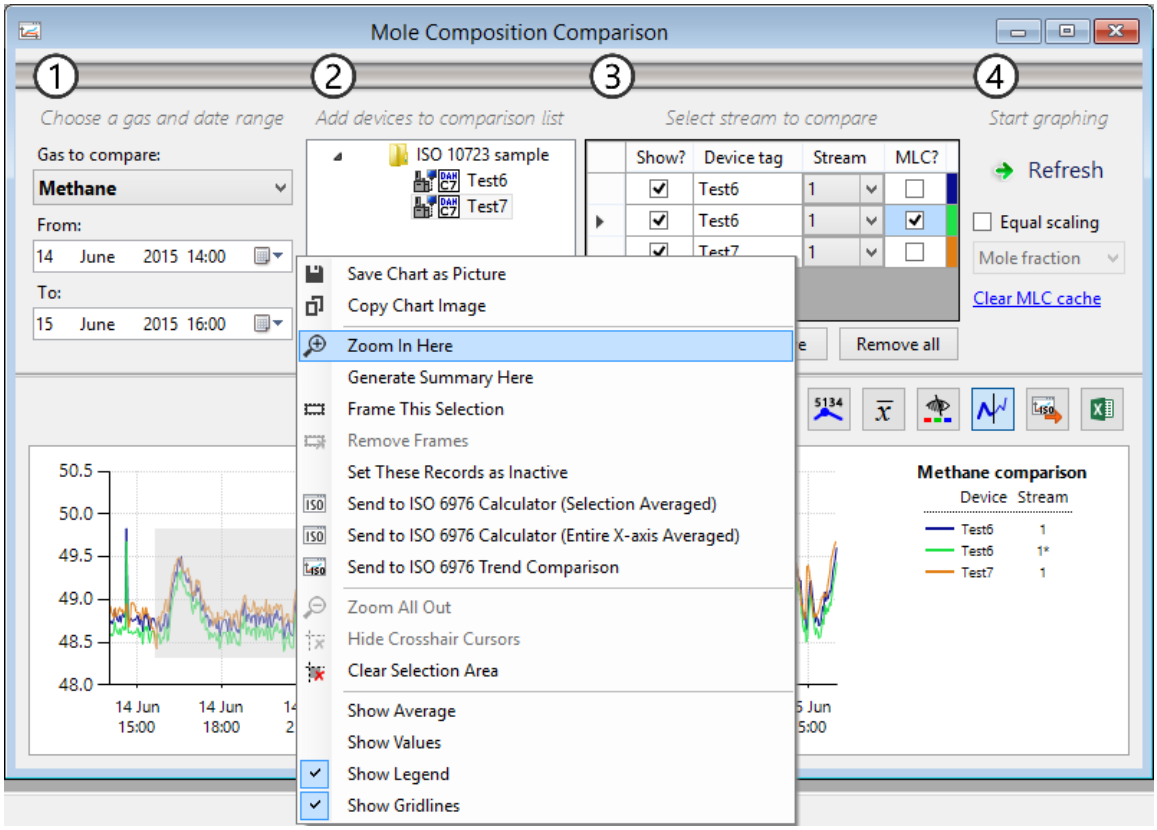


Toggle button to switch between zoom or selection mode.

Zoom mode lets you zoom to a specific area of the chart. Drag a rectangle over the area you want to zoom in. Pan around the chart using the provided scroll bars. Drag another rectangle to zoom in further. To zoom out, click the circled minus button ⊖ on both scroll bars. Press Home on your keyboard or right click the chart and select **Zoom All Out** to undo all zoom-in operations.

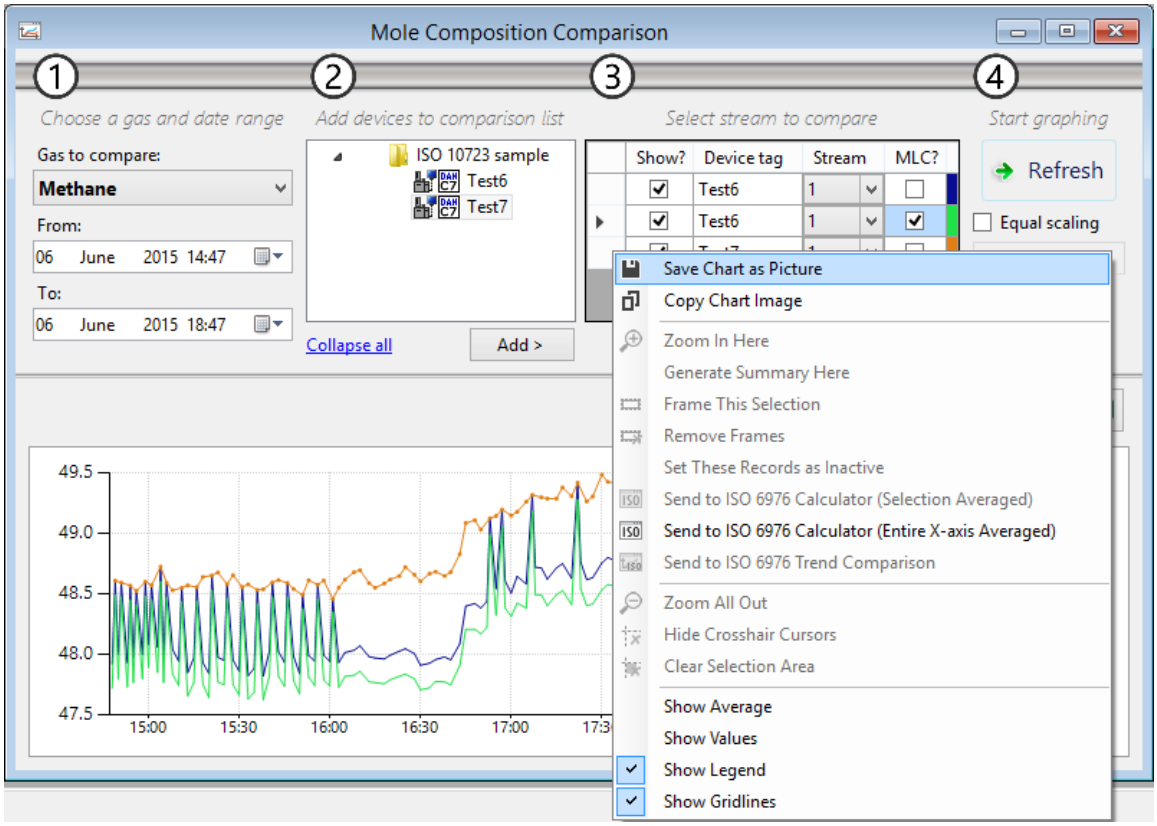


Selection mode enables you to create selection area on the chart, then you can manipulate the records contained inside the selection rectangle using available context menu. Chapter 17.3.8 explains the function of each menu. To clear selection area, right click the chart and select **Clear Selection Area**.



17.3.4 Save or Copy the Chart

To save the chart as image file, right click on the chart and select **Save Chart as Picture**.



Similarly to copy the chart into clipboard, right click and select **Copy Chart Image**. Then you may paste the image onto Microsoft Paint, Microsoft Word, or any software that accepts bitmap image.

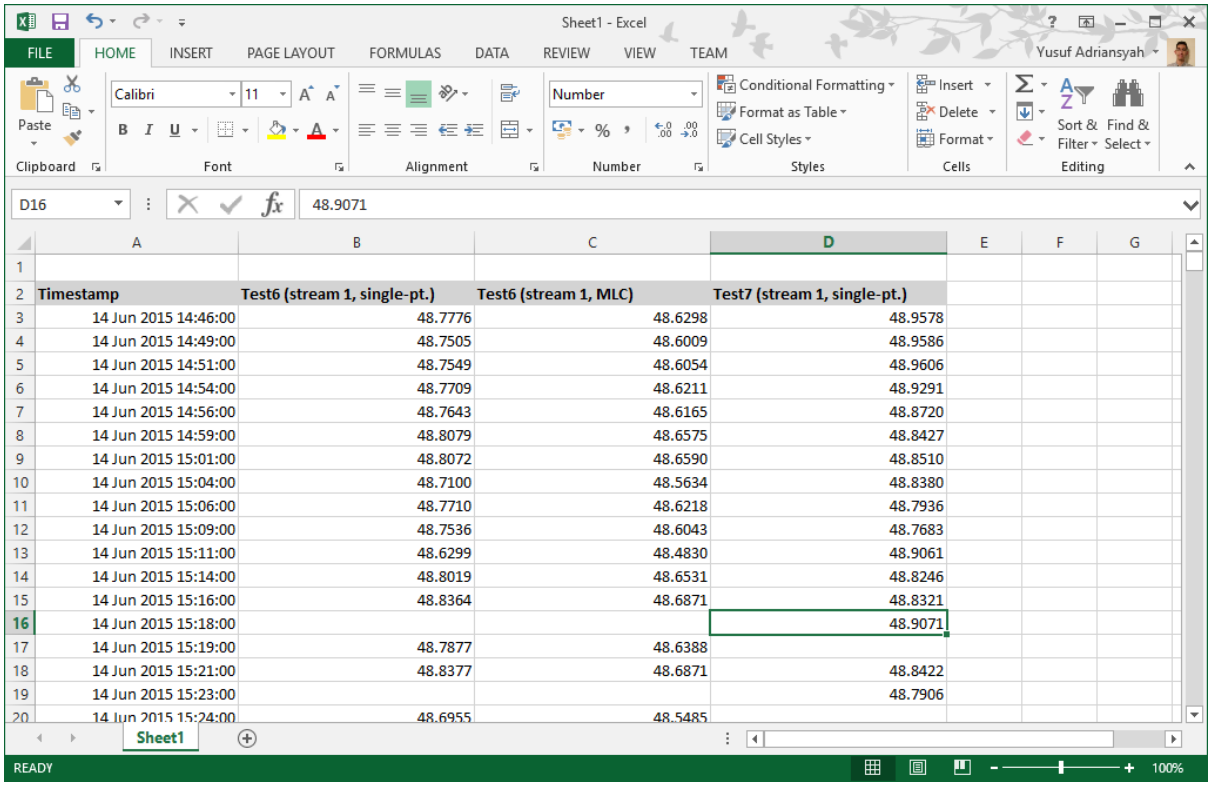
17.3.5 Export Values to Microsoft Excel

Once the chart has been graphed completely, click **Copy to Microsoft Excel**. This button opens a new Excel worksheet. Then GCAS Desktop writes all data point of all line charts available onto this worksheet.

Note

This feature requires Microsoft Excel 2010, 2013, 2016, or later, to be installed.

GCAS Desktop prevents you from exporting to Excel if there are duplicate comparison entries.

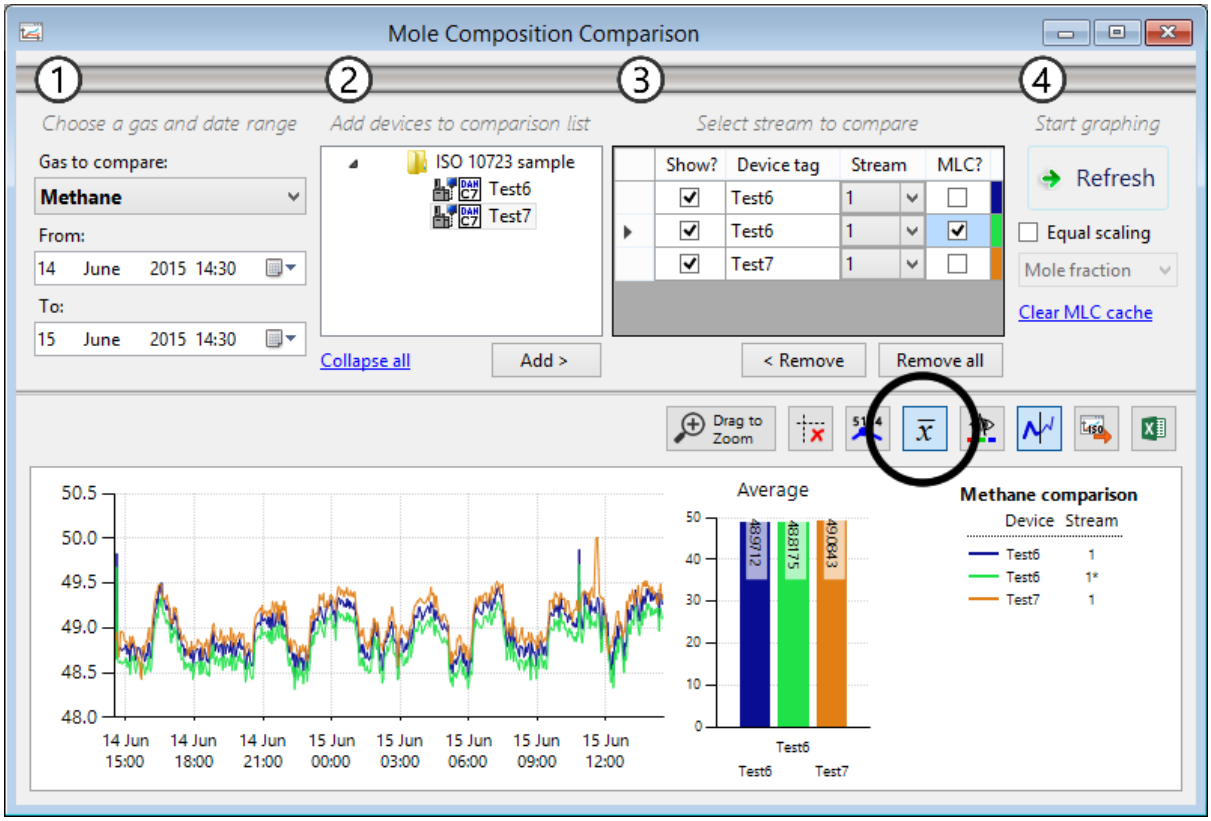


	A	B	C	D	E	F	G
1							
2	**Timestamp**	**Test6 (stream 1, single-pt.)**	**Test6 (stream 1, MLC)**	**Test7 (stream 1, single-pt.)**			
3	14 Jun 2015 14:46:00	48.7776	48.6298	48.9578			
4	14 Jun 2015 14:49:00	48.7505	48.6009	48.9586			
5	14 Jun 2015 14:51:00	48.7549	48.6054	48.9606			
6	14 Jun 2015 14:54:00	48.7709	48.6211	48.9291			
7	14 Jun 2015 14:56:00	48.7643	48.6165	48.8720			
8	14 Jun 2015 14:59:00	48.8079	48.6575	48.8427			
9	14 Jun 2015 15:01:00	48.8072	48.6590	48.8510			
10	14 Jun 2015 15:04:00	48.7100	48.5634	48.8380			
11	14 Jun 2015 15:06:00	48.7710	48.6218	48.7936			
12	14 Jun 2015 15:09:00	48.7536	48.6043	48.7683			
13	14 Jun 2015 15:11:00	48.6299	48.4830	48.9061			
14	14 Jun 2015 15:14:00	48.8019	48.6531	48.8246			
15	14 Jun 2015 15:16:00	48.8364	48.6871	48.8321			
16	14 Jun 2015 15:18:00			48.9071			
17	14 Jun 2015 15:19:00	48.7877	48.6388				
18	14 Jun 2015 15:21:00	48.8377	48.6871	48.8422			
19	14 Jun 2015 15:23:00			48.7906			
20	14 Jun 2015 15:24:00	48.6955	48.5485				

Every device or stream in comparison list has its own column and the rows are timestamps. If there are two or more data points from different devices or streams sharing the exact same timestamp, they are merged into one row in Excel worksheet.

17.3.6 Comparison of Averages

When you click **Go** or **Refresh**, GCAS Desktop renders the chart and at the same time computes the average of each line. These average values are presented on a secondary column chart. Click **Show average chart** button (having icon $\bar{x}$) to bring the average chart visible.

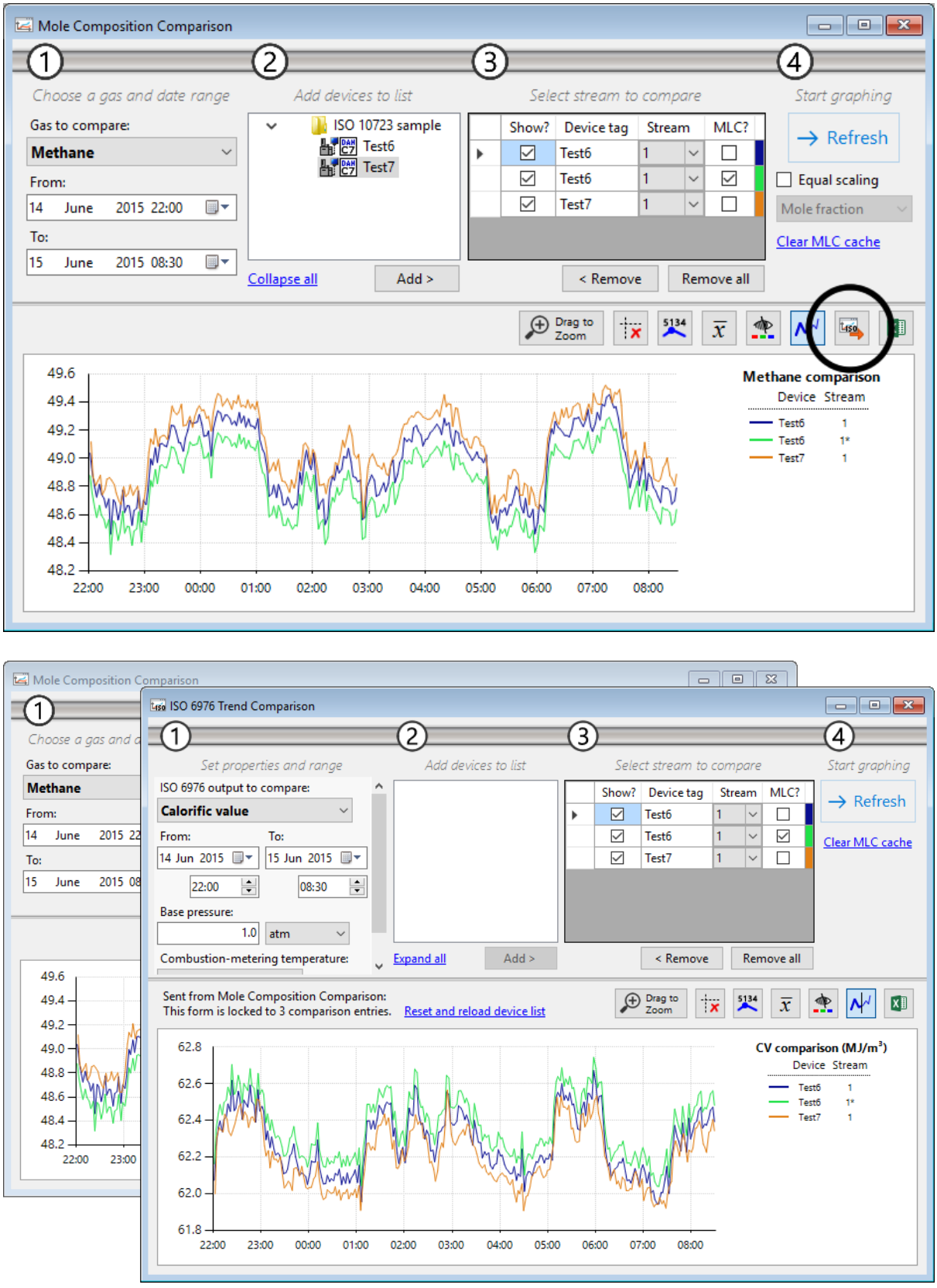


Each comparison entry has its own average bar (or technically 'column' as it is a column chart). Showing or hiding a line chart through the **Show?** check box in the comparison list also displays or conceals its average bar. You can also zoom the average chart in case all bars are of the same height thus making it difficult to see the difference among them, provided that the chart is in zoom mode.

17.3.7 Send to ISO 6976 Trend Comparison

Now that you have the mole composition trend of various devices or streams, ever wondered how much calorific value each stream would stack against one another? If you have the GCAS feature *ISO 6976 Trend* included in your licence, you see the button **Send to ISO 6976 Trend Comparison** is enabled next to Copy to Microsoft Excel button.

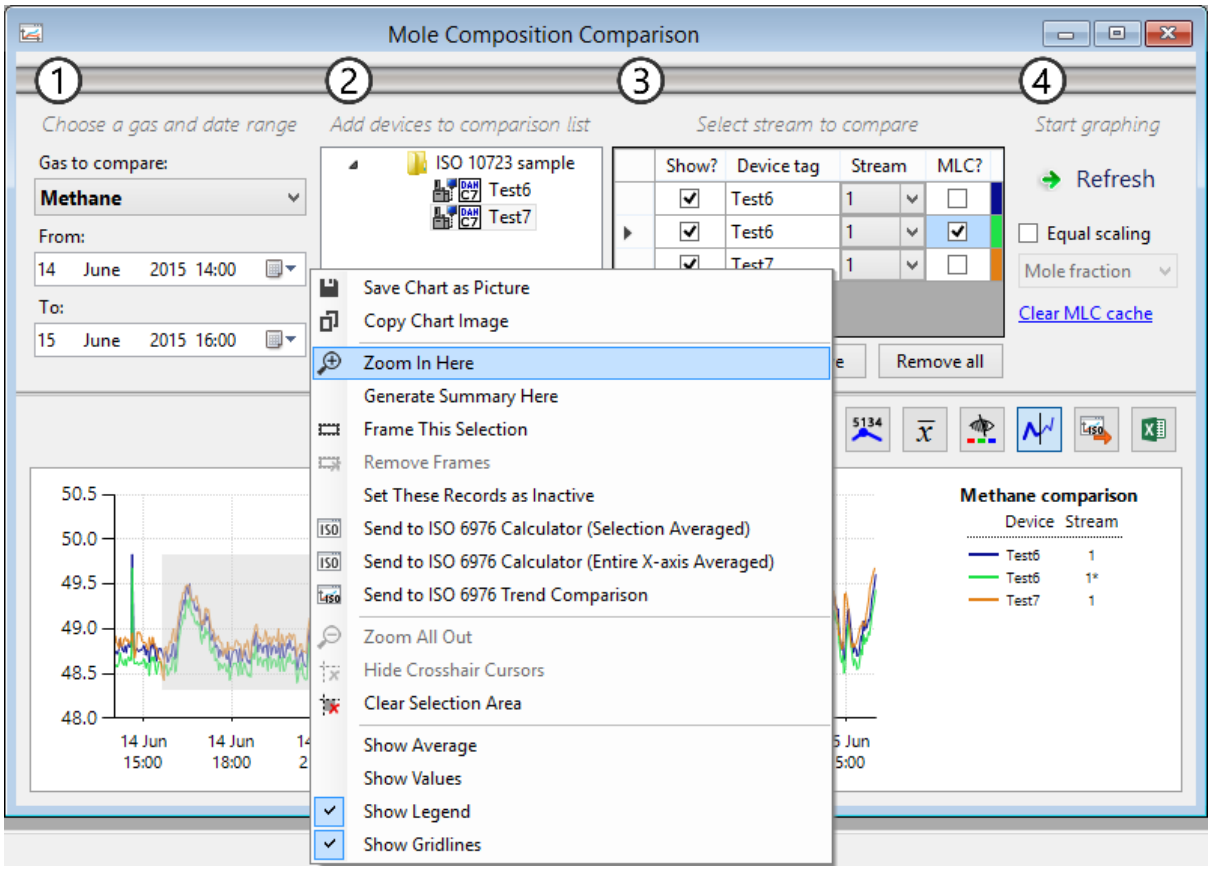
This button calls ISO 6976 Trend Comparison form and communicates the necessary information such as the plot range and content of the comparison list. Then ISO 6976 Trend Comparison form handles the rest. Because this "Send to" shortcut bypasses some of the ISO 6976 Trend Comparison's standard startup routines, the ISO 6976 Trend Comparison form is locked to your comparison list only. To reset the form, click **Reset and reload device list**.



Send to ISO 6976 Trend Comparison button transmits the entire plot range. To compare ISO 6976 trends for a limited range, switch Mole Composition Comparison form to selection mode and use the right-click menu **Send to ISO 6976 Trend Comparison** as illustrated in chapter 17.3.8.

17.3.8 Selection Mode Menus

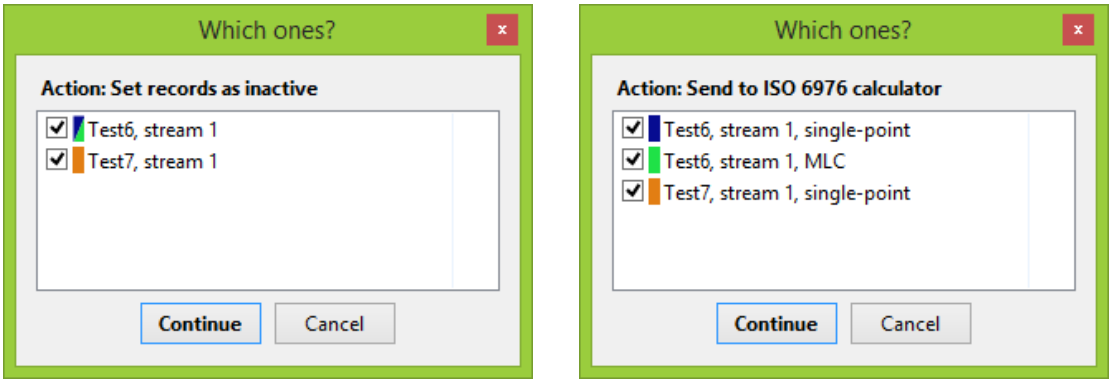
These menus are available if the form is in selection mode and there is a selection area. Unlike Data Analysis, Mole Composition Comparison requires the selection area to be *contiguous*, that is, no record (dots on chart) jumping out from selection rectangle then return back inside. If your selection area is not contiguous, GCAS Desktop will alert you and propose a corrected selection area. Nonetheless if you disagree with the new selection area, click Cancel on the message box.



Menu	Function
Zoom In Here	Zooms in to the selection area.
Generate Summary Here	Generates statistical summary for the selected area.
Frame This Selection	Literally puts a rectangular frame around the selection, for presentation purpose. This works on the average chart too.
Remove Frames	Deletes all frames created through *Frame This Selection* menu.
Set These Records as Inactive	Sets all records within the X-axis range of the selection area as inactive. GCAS Desktop displays an additional dialogue if your selection area covers several devices/stream numbers.
Send to ISO 6976 Calculator (Selection Averaged)	This menu requires *ISO 6976 Calculator* in GCAS licence. It sends the averaged mole composition value of all gases of all records contained inside the selection area to ISO 6976 Calculator. As the chart has only one gas, the entire data table is reloaded from the

	database. GCAS Desktop displays an additional dialogue if your selection area covers several devices/stream numbers.
Send to ISO 6976 Calculator (Entire X-axis Averaged)	This menu requires *ISO 6976 Calculator* in GCAS licence. It sends the averaged mole composition value of all gases of all records in the entire X-axis. Actually it doesn't even need a selection area. GCAS Desktop displays an additional dialogue if you have more than one comparison entry in the comparison list.
Send to ISO 6976 Trend Comparison	This menu requires *ISO 6976 Trend* in GCAS licence. It loads the ISO 6976 Trend Comparison form and instructs the form to compare ISO 6976 values based on the mole composition records contained inside the selection area. Contrast to Send to ISO 6976 Trend Comparison button, this menu transmits the X-axis range of selection area rather than the entire plot range.

These three menus **Set These Records as Inactive**, **Send to ISO 6976 Calculator**, and **Send to ISO 6976 Trend Comparison** may trigger a further confirmation if your selection area covers more than one device or one stream. Please confirm which device(s)/stream number(s) to have their records set as inactive or be sent to ISO 6976 Calculator or to ISO 6976 Trend Comparison tool. Setting as inactive merges two comparison entries having same device, same stream number, but different single-point/MLC switch value. MLC capabilities require *ISO 10723* in GCAS licence.

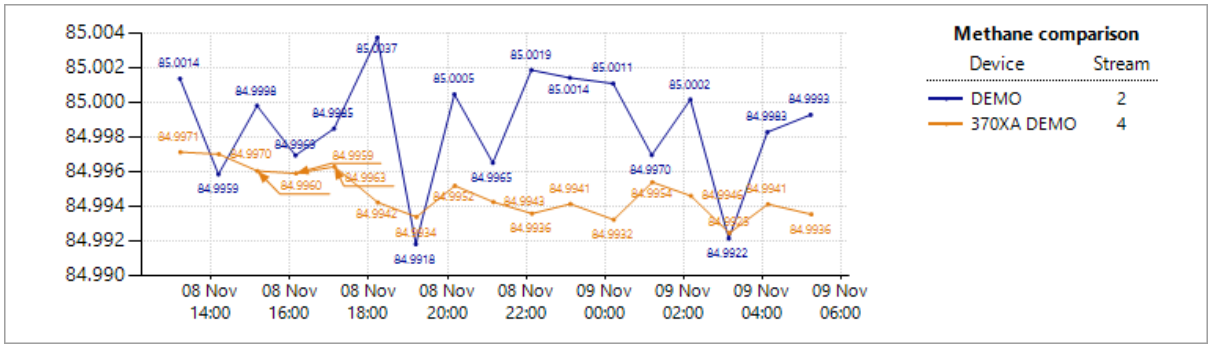


Confirmation dialogue boxes. Tick which device(s)/stream(s) then click Continue.

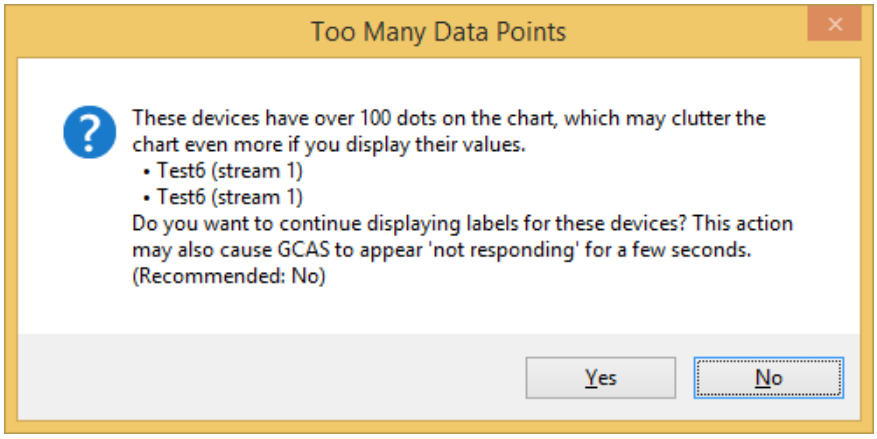
GCAS Desktop opens as many ISO 6976 Calculator forms as necessary and sets their descriptions accordingly, so you know which is which.

17.3.9 Other Visual Cues

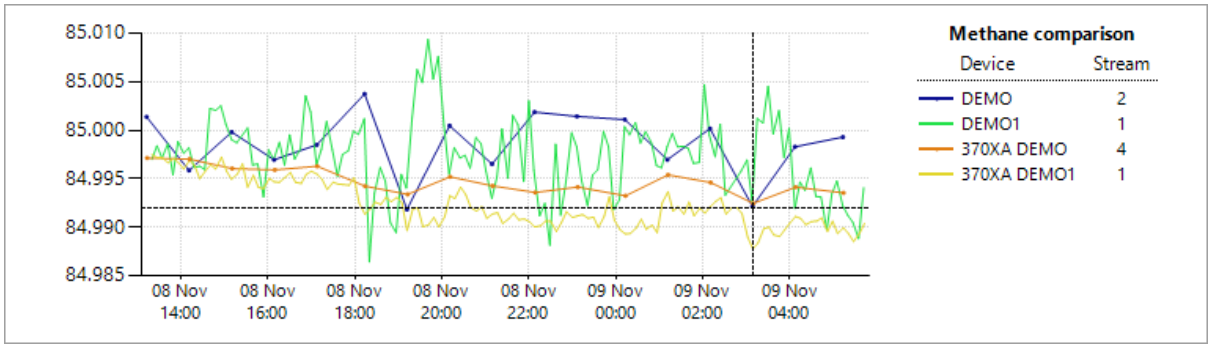
Click **Show values** or right click the chart and select **Show Values** to display the mole composition values.



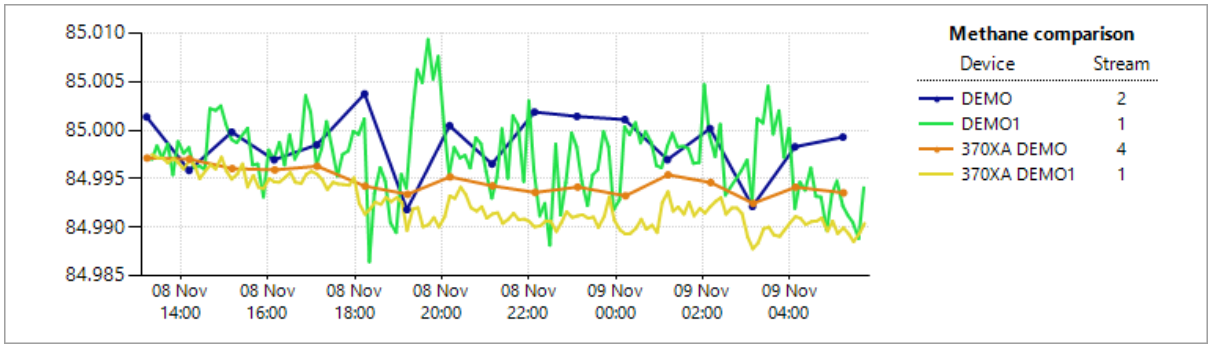
GCAS Desktop prompts a warning if one or more devices have over 100 dots on the chart. We do not recommend to display value labels on line charts with over 100 dots because it will clutter the chart area. Nevertheless you can choose to continue displaying labels despite the 100+ dots, just be informed that GCAS Desktop may appear 'not responding' for a while because the layout engine of the chart is busy.


Too Many Data Points
These devices have over 100 dots on the chart, which may clutter the chart even more if you display their values.
• Test6 (stream 1)
• Test6 (stream 1)
Do you want to continue displaying labels for these devices? This action may also cause GCAS to appear 'not responding' for a few seconds.
(Recommended: No)
Yes
No

These dashed lines are called *cursors*. Cursors appear when you click on a chart or as a remnant of zoom operation. Cursor may act as a guide to compare Y-axis values of two data points. Click **Hide crosshair cursors** or right click on a chart and select **Hide Crosshair Cursors** to hide these lines from view.

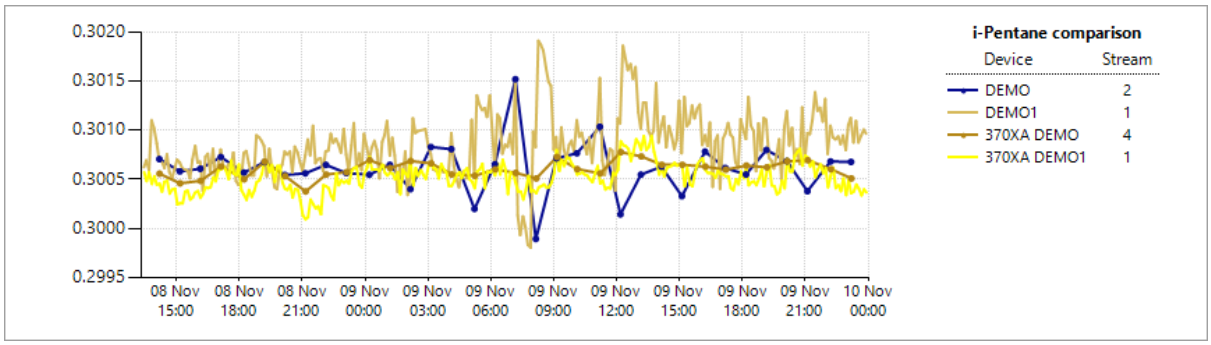


By default, GCAS Desktop draws the chart using a thin line. The toggle button **Use thin line** is pressed by default. If you prefer the usual thick lines, click this button to raise it from its pressed state.



17.3.10 Colourblind Assistance

To aid users with colour blindness (protanopia and deuteranopia), GCAS Desktop provides an alternative colour scheme for the chart. Use the **Colourblind assist** button to switch colour scheme.



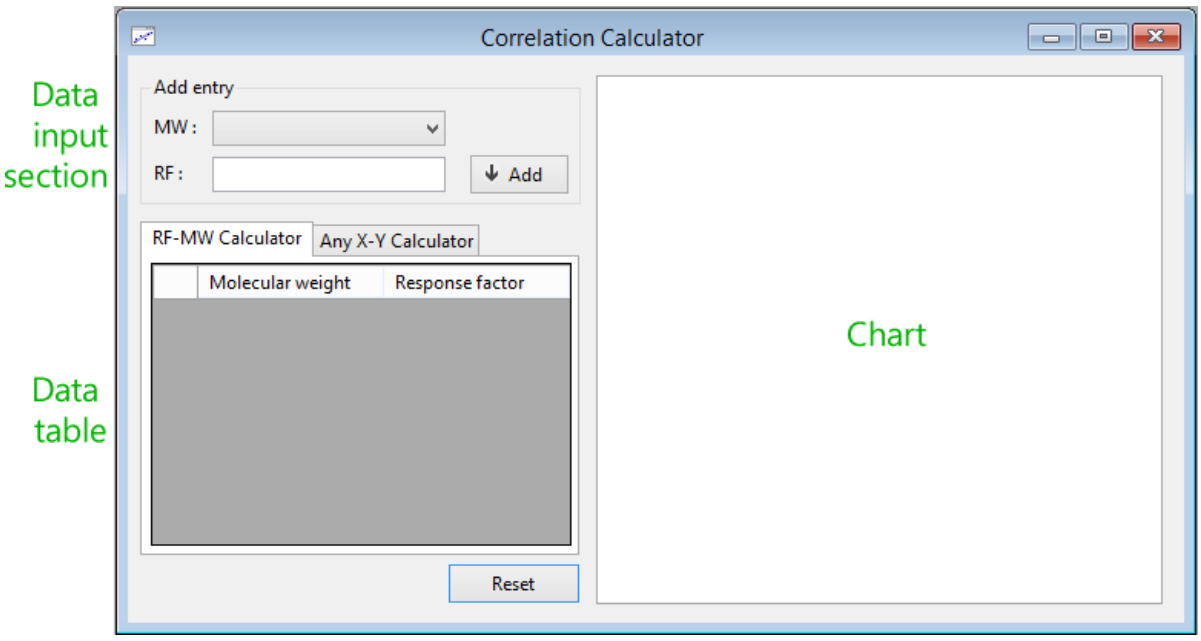
Alternative colour scheme when colourblind assist is turend on.
Colourblind assistance works better with thick lines like in this screenshot.

18 Correlation Calculator

Correlation Calculator is a tool to find the R^2 (correlation) value for arbitrary number of data. Footprint and Calibration Data already calculated R^2 value of the calibration record, however they follow a certain order of components/gases for each GC device type. If you need to calculate the correlation value without following those rules, use this Correlation Calculator tool instead. This tool does not only calculate RF-MW correlation like those in Footprint or Calibration Data, but also calculates correlation of any *x* and *y* number pair.

18.1 The *Correlation Calculator* Form

To open Correlation Calculator, go to the Tools menu > **Correlation Calculator**. Correlation Calculator can also be opened through *Send to* shortcut, such as from Footprint or Calibration Data or from Data Analysis. This Correlation Calculator form has three sections which are data input section, data table section, and chart section.

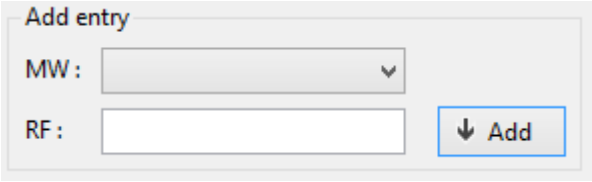


This calculator has two modes, named *RF-MW Calculator* and *Any X-Y Calculator*. The first mode calculates the correlation value for the given pairs of RF (response factor) and MW (molecular weight). On the other side, *Any X-Y Calculator* computes the correlation value for the given pairs of arbitrary X and Y values. Use this mode if you need the X-axis to be something other than the logarithm of molecular weight.

The active tab on the data table section indicates current active mode. Switch tab to change mode.

18.2 RF-MW Calculator

Switch to *RF-MW Calculator* tab on the data table section. This would change the data entry section to the screenshot below.



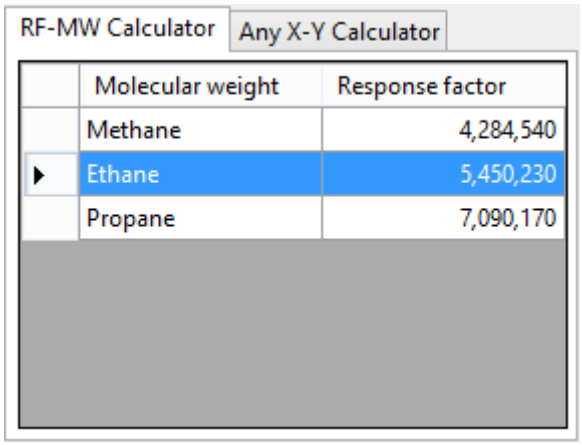
Add a new entry by selecting the desired gas from the *MW* (molecular weight) dropdown, and type its response factor value in the *RF* text box. Click **Add** to insert this entry into data table. This entry is also graphed on the chart immediately.

Note

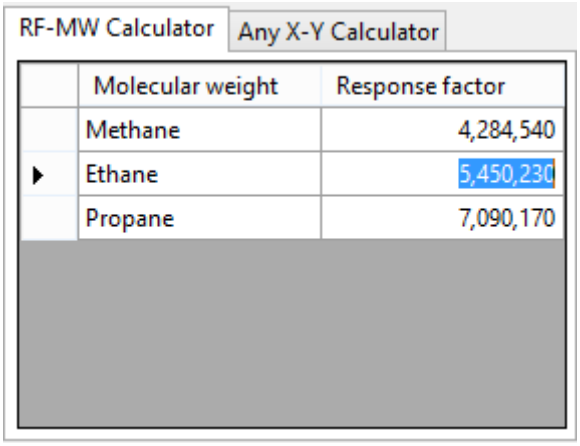
You cannot add the same gas more than once. Should the selected gas has existed in the data table section, GCAS Desktop presents a warning message.

You cannot put negative number in response factor entry field because logarithm of negative numbers are undefined.

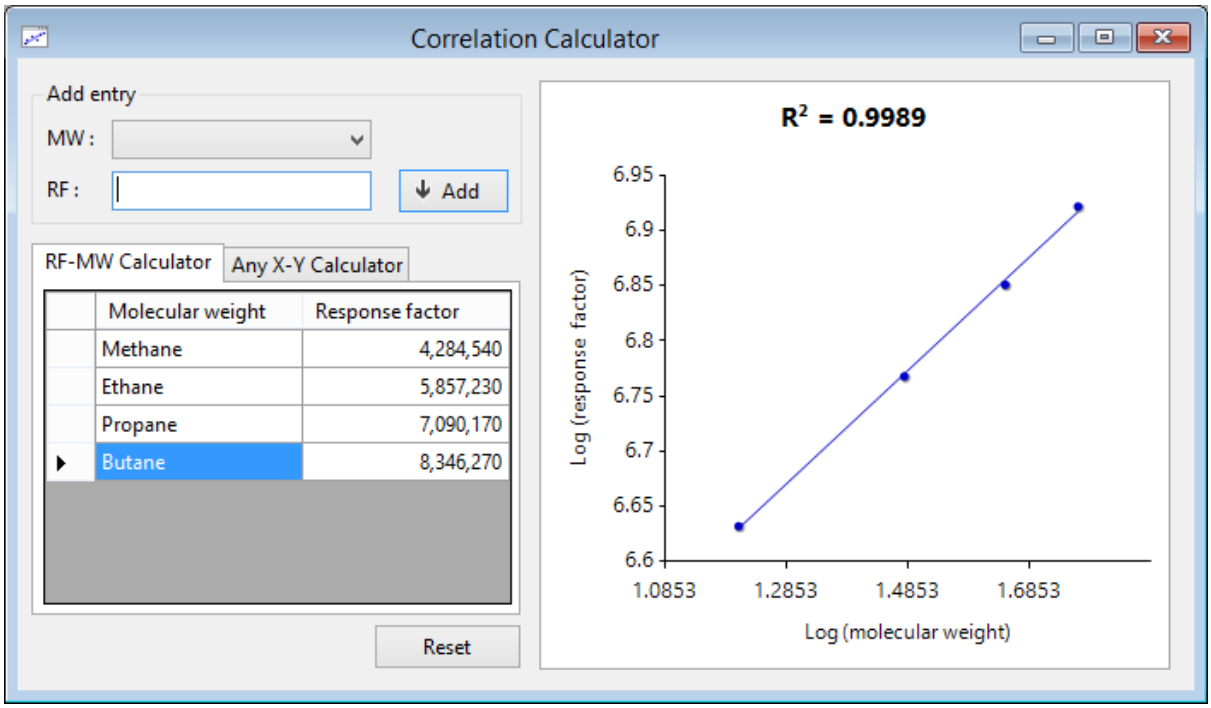
To remove one or more entries, click row header(s) to highlight data row(s) you wish to delete. Next, press `Delete` on your keyboard. The corresponding dot(s) on the chart will disappear as well.



You can edit the response factor value should a mistake happened. Double click the response factor cell, enter the correct value, then press `Enter` to commit. The corresponding dot on the chart shall move upwards or downwards according to the new response factor value.



Whenever there are minimum **three** entries in data table, GCAS Desktop computes the regression line and calculates their correlation. The R^2 value is displayed at the top of the chart. Regression line and R^2 value are also updated after changes of existing RF values are committed. If you remove several entries leaving less than three in data table, both regression line and R^2 value disappear from the chart.

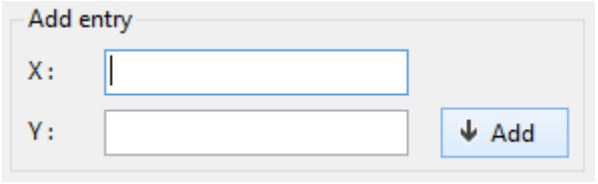


Note

Correlation data sent from Data Analysis' context menu *Send to Correlation Calculator* may include gases with unrelatable correlation such as i-butane, i-pentane, nitrogen, and carbon dioxide. GCAS Desktop display these gases as red dot in the R^2 chart, indicating they should be removed.

18.3 Any *X-Y* Calculator

Switch to *Any X-Y Calculator* tab on the data table section. This would change the data entry section to the screenshot below.

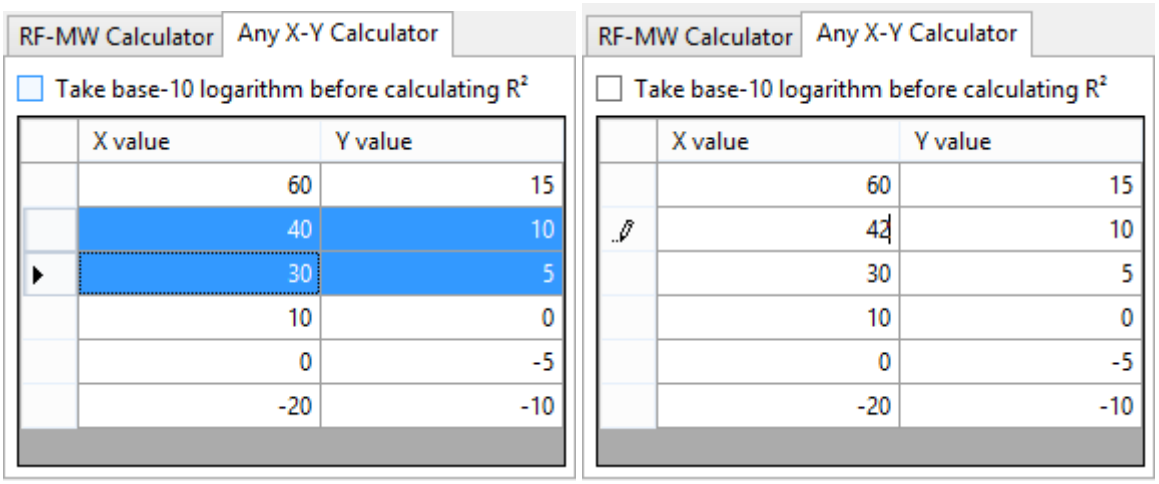


Unlike RF-MW calculator, here you can enter literally *any* real numbers for X and Y values. Click **Add** to insert this entry into data table. This entry is also graphed on the chart immediately.

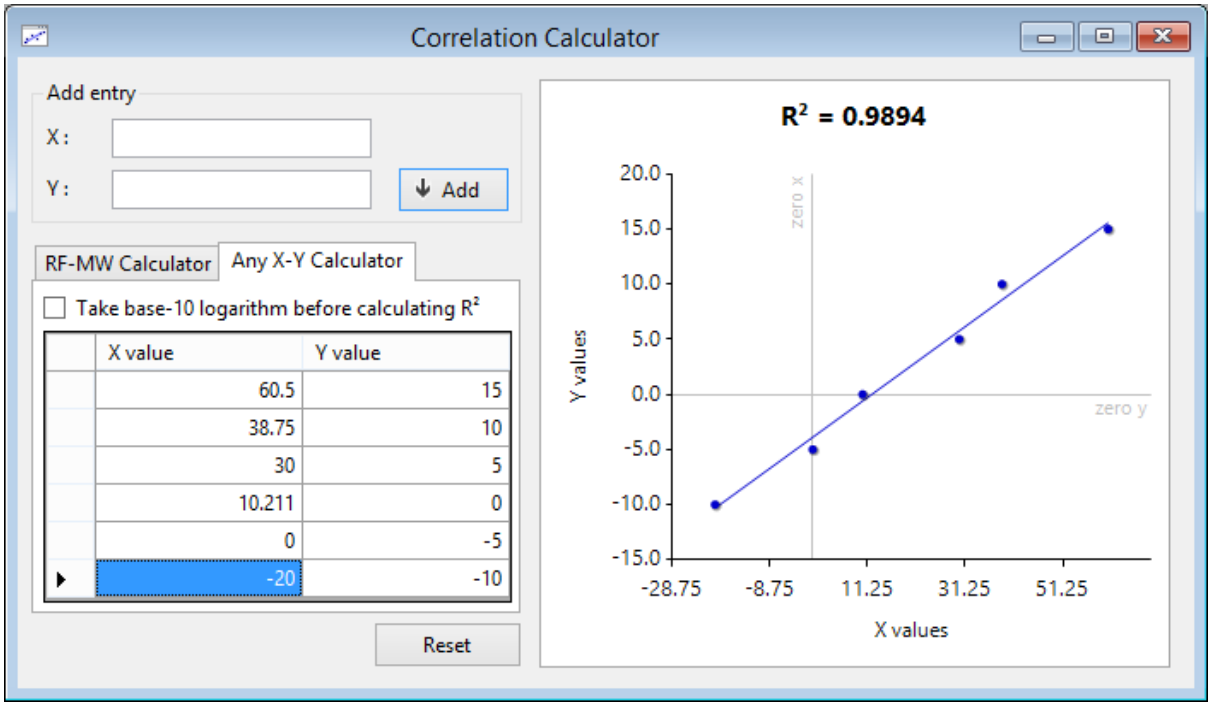
Note

If you need to find the correlation of the *logarithm* of X and Y instead of just X and Y, visit the next chapter Any log(X)-log(Y) calculator.

Similar to RF-MW Calculator, to delete one or more entries you need to highlight the row(s) and then press `Delete` on your keyboard. In addition, to edit the X value or Y value, double click on the corresponding cell to enter edit mode. Press `Enter` on your keyboard to commit the change and to update the chart.



As soon as there are **three** entries or more, GCAS Desktop calculates the regression line and correlation value. This chart updates automatically if there are entries removed or edited.



18.4 Any log(X)-log(Y) Calculator

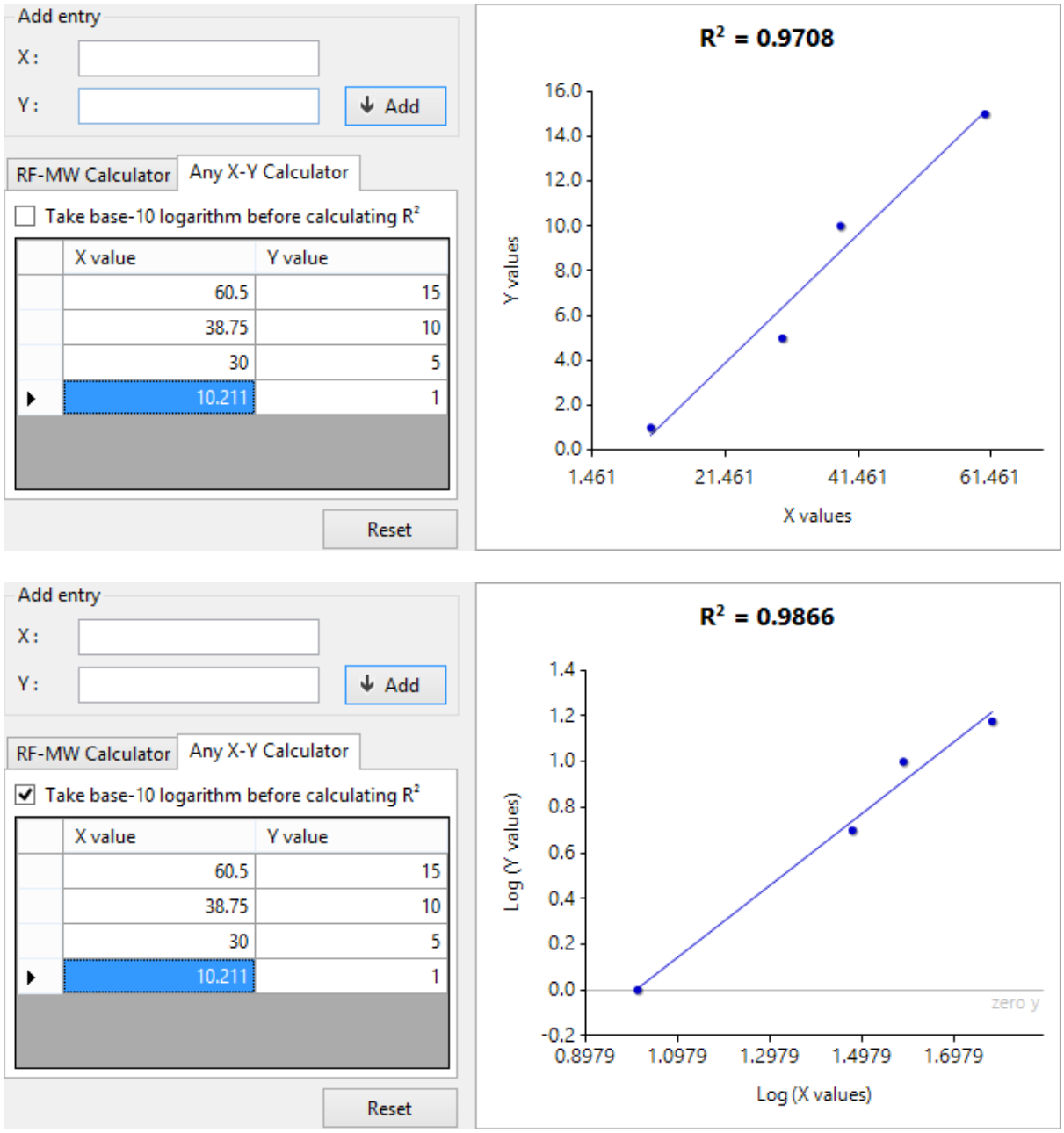
Any X-Y Calculator has another option calculate the correlation of $^{10}\log X$ (base-ten logarithm of X) against $^{10}\log Y$, instead of just X against Y. To use this option, switch the Correlation Calculator to *Any X-Y Calculator* mode, then begin entering pairs of X and Y values as usual.

When you are done, tick the check box **Take base-10 logarithm before calculating R²**. GCAS Desktop computes the logarithm of both X and Y value in each pair, updates the chart, and finally recalculates the regression line and the correlation (R^2 value).

Note

This time, do not enter zero or negative numbers in any X values or any Y values. Logarithm of 0 yields negative infinity and is not graphable. Logarithm of negative numbers are undefined. If GCAS Desktop encounters zero, it will change it to one (1). If GCAS Desktop finds a negative number, GCAS Desktop replaces it with the absolute value of that number.

Unticking the check box will revert this calculator tool to the regular *Any X-Y Calculator* mode.



Difference between regular X-Y correlation (top) and logarithmic X-Y correlation (bottom).

19 ISO 6976 Calculator

ISO 6976 Calculator is a tool to calculate the calorific value (CV), molar mass composition, Wobbe index, relative density, and standard density of any given mole composition, as defined by ISO 6976:1995 standard.

Note

To use ISO 6976 Calculator, you need the GCAS feature *ISO 6976 Calculator* in your GCAS licence.

ISO 6976 calculation takes four inputs:

1. Mole composition,
2. Base pressure,
3. Combustion temperature,
4. Metering (base) temperature.

Mole composition input may come from a manual input or an existing record. Base pressure is typically the atmospheric pressure (1 atm or 101,325 Pa). Combustion and metering temperature affects the constants used in the calculation, therefore GCAS Desktop limits the available selection of combustion-metering temperature pair into six pairs:

- 0°C / 0°C
- 15°C / 0°C (combustion temperature = 15°C, base temperature = 0°C)
- 25°C / 0°C
- 15°C / 15°C (the default)
- 20°C / 20°C
- 25°C / 20°C

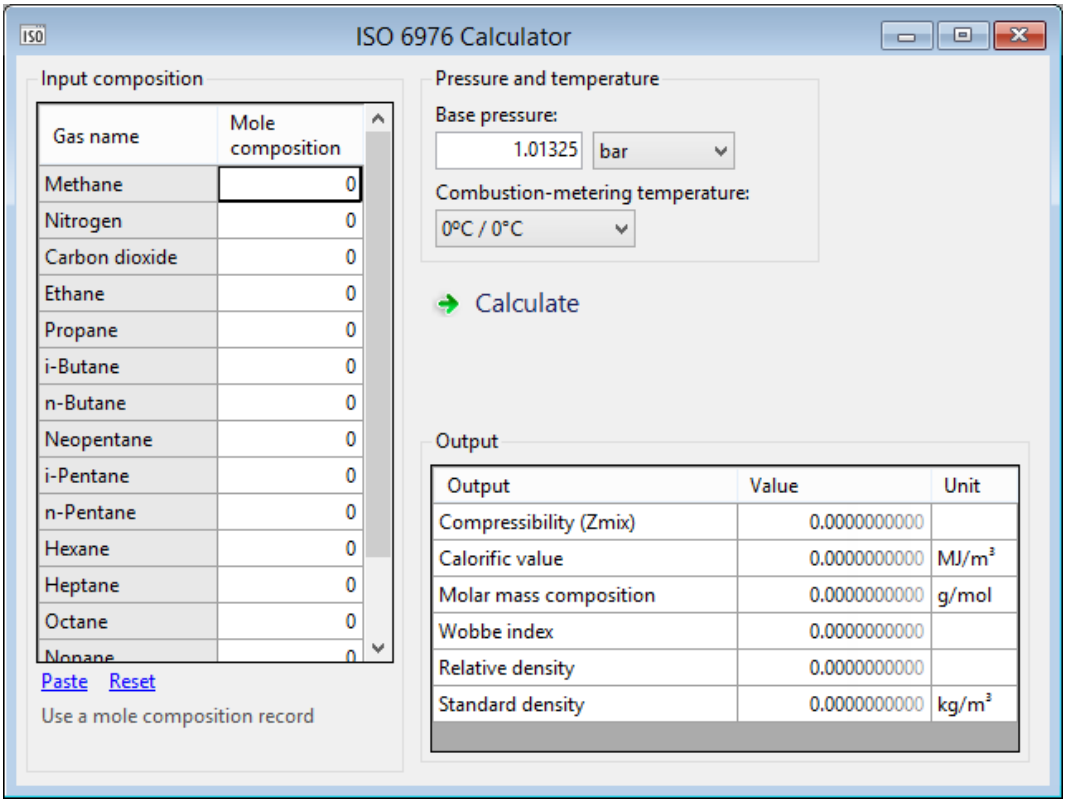
19.1 The *ISO 6976 Calculator* Form

There are multiple ways to open ISO 6976 Calculator form:

1. For one-time offline calculation: Go to the **Tools** menu on GCAS Desktop main window and then select **ISO 6976 Calculator**. Through this menu, you will enter the mole composition *by hand* (manual input) or through copy-and-paste.
2. Sent by Mole Composition form. Open the desired mole composition record, go to the Action menu, and select **Send to ISO 6976 Calculator**. If you have GCAS feature ISO 10723 as well, choose which one to send either the single-point or the MLC. Through this method, ISO 6976 Calculator form uses the selected mole composition record.
3. Sent by Calibration Gas Certificate. Open the desired calibration gas certificate, go to the Action menu, and select **Send to ISO 6976 Calculator**. By this way, ISO 6976 Calculator form uses the mole percentage portion of the selected calibration certificate.
4. Sent by Data Analysis. Graph some mole composition trend, put the Data Analysis form in selection mode, drag a selection rectangle, then right click the chart and select **Send to ISO**

6976 Calculator. Records inside the selection area are averaged and then sent to ISO 6976 Calculator form.

5. Sent by Mole Composition Comparison. Load a range of records, then right click the comparison chart and select either **Send to ISO 6976 Calculator (Selection)** or **Send to ISO 6976 Calculator (Entire X-axis)**. The former requires a selection area while the latter doesn't. You may need to confirm which device(s)/stream(s) to be sent to ISO 6976 Calculator.



The grid on the left is the mole composition input. Grey cells are not editable. This grid contains all 15 gases from methane to decane, including neopentane. If you are to enter the composition manually, be careful if your GC device does not read several gases (such as C6+ devices do not have heptane through decane). Some GC devices do not read neopentane as well. In such cases, set the composition of unavailable gases to zero. More details about inputting composition are on chapter 19.2.

At the top centre region of the form, set the base pressure and combustion-metering temperature pair. When all inputs are correct, click **Calculate**.

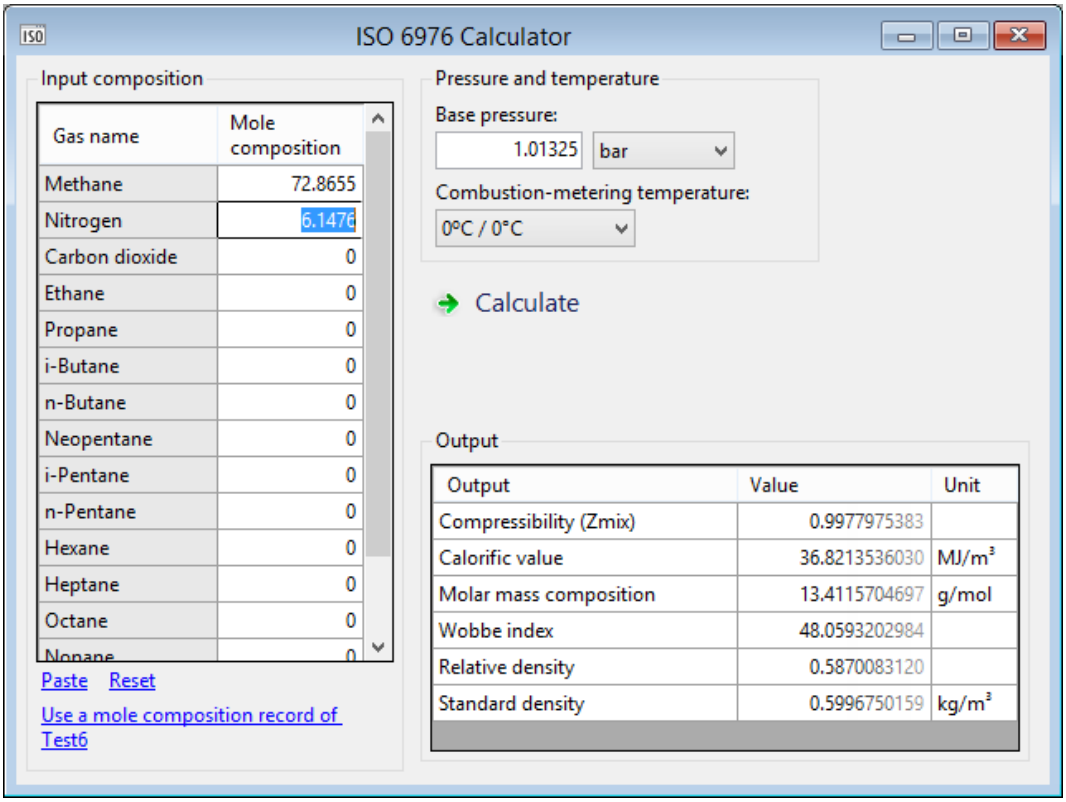
Calculation results are displayed on the grid at the bottom region. In addition of five properties of ISO 6976 standard, the calculator also displays the compressibility factor (Z) of the input composition.

19.2 Ways to Enter Composition

Input composition can come from a manual input, copy-and-paste, or an existing record.

19.2.1 Manual Input

Go to the input composition grid. Press F2 or double click the cell to invoke edit mode. Then, type the numbers. There is *total* row at the bottom of the grid. You might need to scroll the grid or resize the form. This *total* row is updated everytime you finished editing a cell.



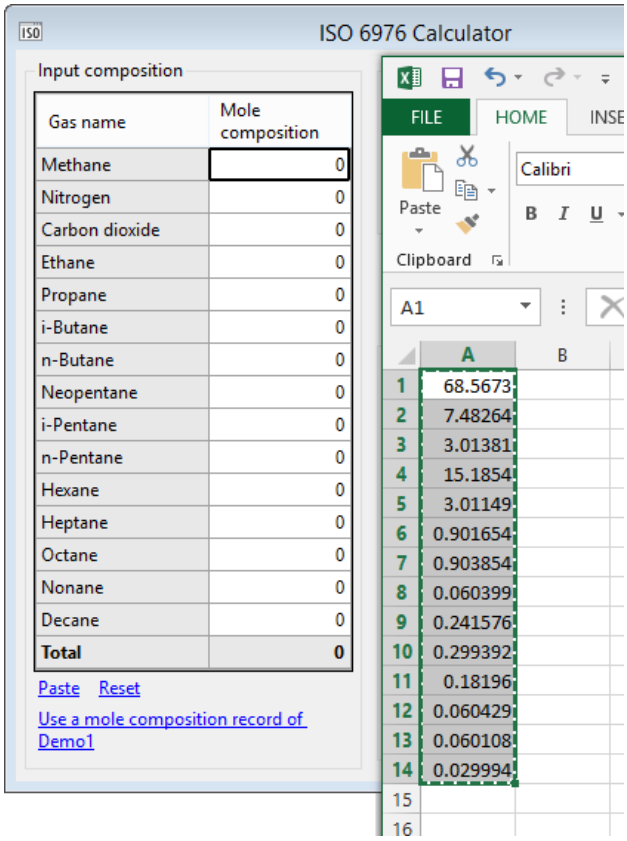
Take extra care about the gases your GC device doesn't read. For example, a C7+ device has no octane, nonane, and decane. Some GC devices do not read neopentane too. Set the composition of these unavailable gases to zero.

Click **Reset** to reset all numbers back to zero.

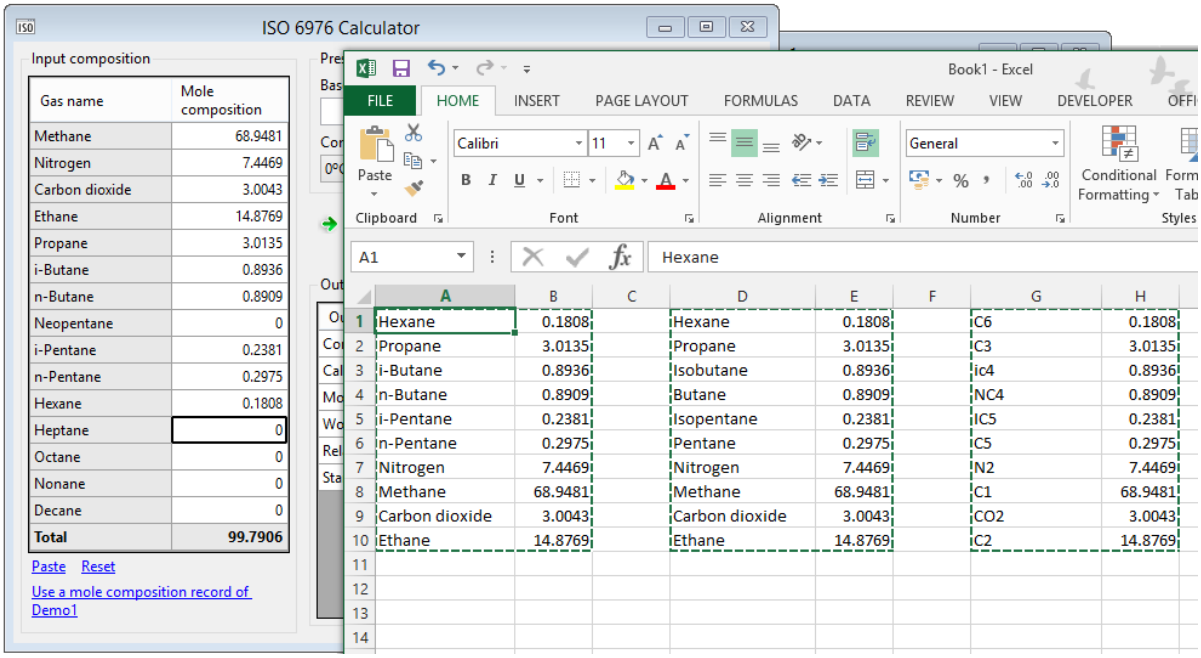
19.2.2 Normal Paste and Smart Paste

Copy a block of cells from Microsoft Excel or your favourite spreadsheet processing software, then click **Paste** at ISO 6976 Calculator form. If your block of cells has one column, GCAS processes a normal paste. If it has two, GCAS processes a smart paste.

Normal paste is like the Paste button on Microsoft Excel; it pastes the cells sequentially. Some safeguards are cells containing non-number like alphabets will translate into zero, and negative numbers are converted into positive.



Smart paste works for two-column data. First column must be the gas name. Second column is the value. The good thing is, you don't have to worry about gas order as GCAS Desktop will reorder the gases into the correct sequence. GCAS Desktop recognises the standard gas names (e.g. "Methane", "Ethane", "i-Butane") as well as some well-known names (e.g. "Isobutane", "Pentane"—translated as normal pentane or n-Pentane), and even their C-number notation. Gas names are not case-sensitive. Having said that, these three blocks of cells below will work.



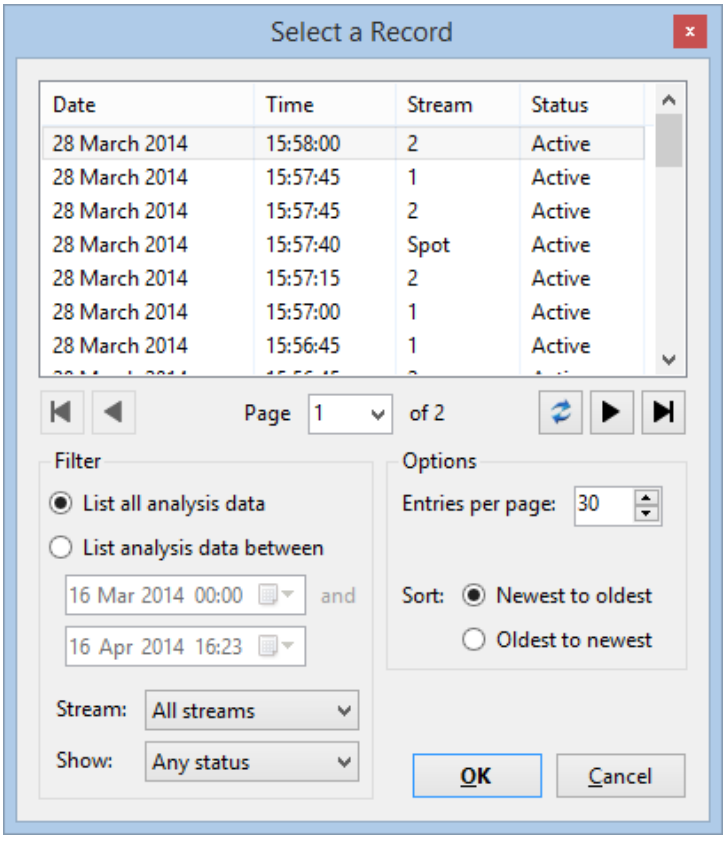
19.2.3 Load a Mole Composition Record

To use a mole composition record, we have two methods. Both require *Live Data Analysis* feature in your GCAS licence.

First method as already described in chapter 8.9: Open a Mole Composition form, go to the Action menu, and select **Send to ISO 6976 Calculator**.

Second method is described below.

1. Go to the Tools menu > ISO 6976 Calculator on GCAS Desktop main window.
2. While ISO 6976 Calculator window is open, select the device from your device panel or recent device panel.
3. Look under the input grid. Click **Use a mole composition record of <*device name*>**. The <*device name*> follows the actual device you are selecting, and is updated whenever you change the selected device on main window.
4. That link opens a *Select Record* dialogue. Pick a record and click **OK**.

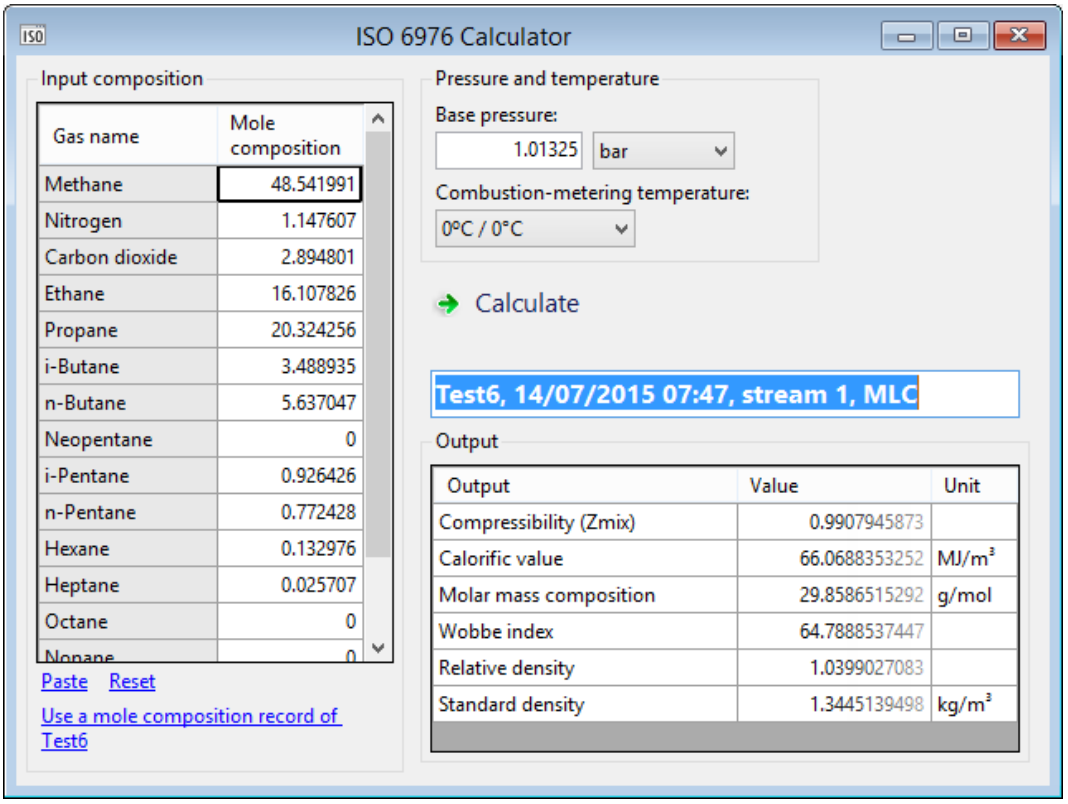


19.2.4 Load a Calibration Certificate

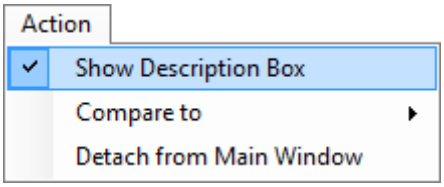
Open a Calibration Gas Certificate form, browse to the desired certificate, the go to the Action menu and select **Send to ISO 6976 Calculator**. The ISO 6976 Calculator form shall load the mole percentage portion of the calibration certificate.

19.3 Add Description

Description is an optional text for presentation purpose only. When there are multiple ISO 6976 Calculators open at the same time, add a text description to each of them hence you can easily identify which is which.



Open the Action menu and select **Show Description Box**. This reveals a text box above the output section of the form. Enter any description to this text box. To hide this text box, open the Action menu and clear the check mark on **Show Description Box**.



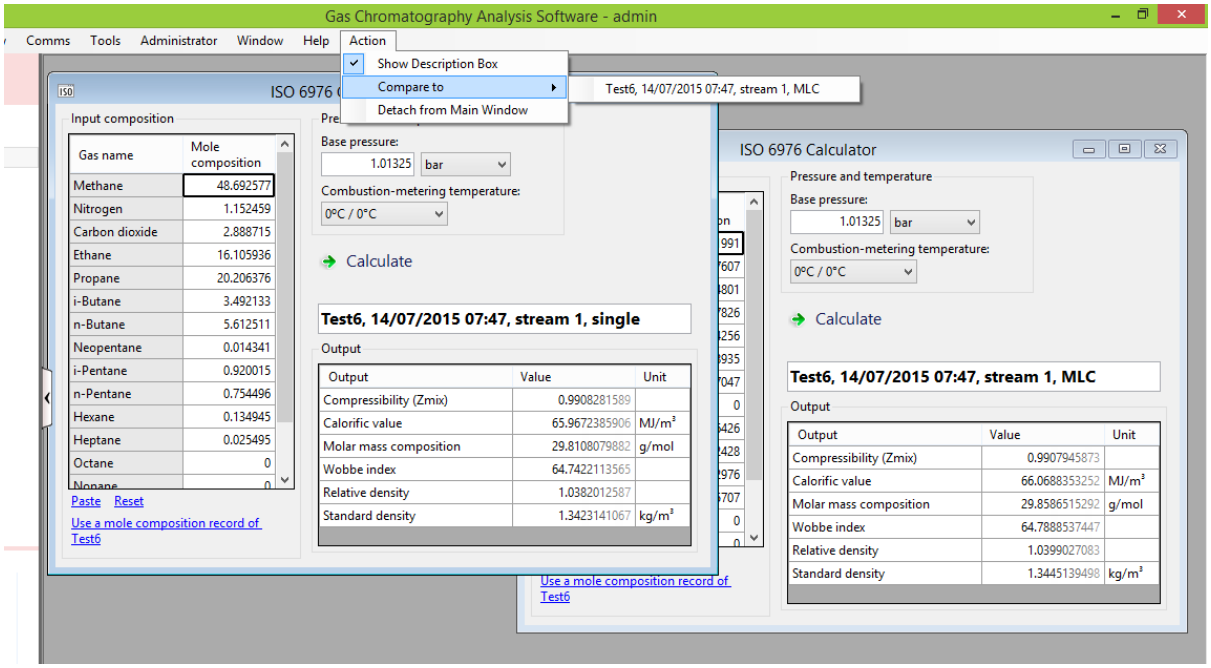
Description text is used when you are switching windows through the *Window* menu on the main menu bar, and when you are comparing two ISO 6976 Calculators. GCAS Desktop automatically fills the description text for cases where ISO 6976 Calculator is opened through a *Send to* shortcut from Data Analysis or Mole Composition Comparison.

19.4 Compare Two ISO 6976 Calculators

Ever wondered how much is the difference of CV between two ISO 6976 Calculators? Wonder no more. Starting from GCAS Desktop version 1.7.3.0, ISO 6976 Calculator has been equipped with a

comparison tool. Probably the most common use for comparing two ISO 6976 results is when you are calculating how much the CV difference is between single-point mole composition stream and its multilevel-calibration counterpart.

To make a comparison, first add description to each ISO 6976 Calculator form you wish to compare. Next, go to the Action menu and select **Compare To**, then choose the target ISO 6976 Calculator form which appeared on the submenu. If you didn't add description, the submenu simply says "`(no description)`". It will become problematic if there are three or more ISO 6976 Calculators open and none of them has description.

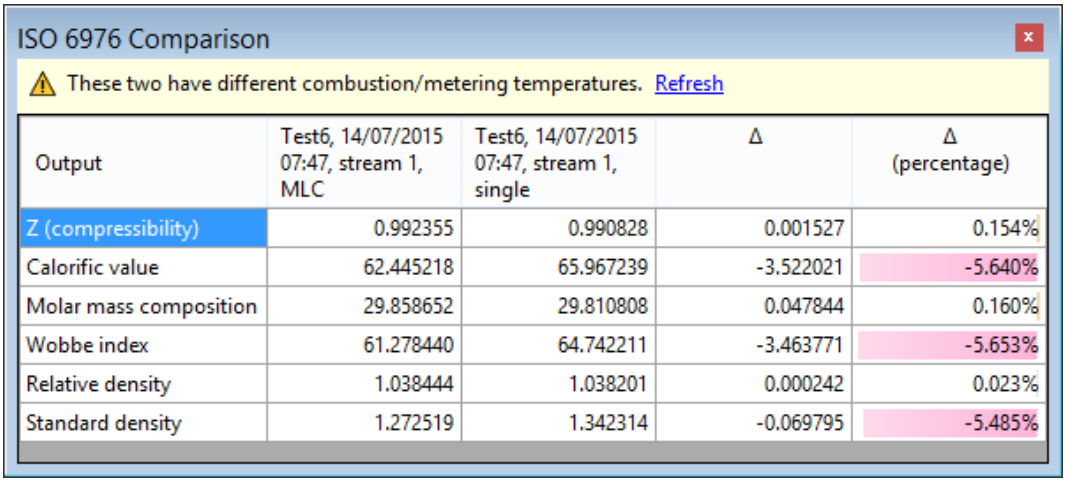


This is the *ISO 6976 Comparison* form. It compares all ISO 6976 outputs between the two calculator forms. Left column is the ISO 6976 Calculatorwhich initiated comparison, let's call it A. The right column is the ISO 6976 Calculator selected as comparison target, let's call it B. Then you get the delta (difference) which is A minus B, and finally the delta expressed in percentage relative to A. Units in ISO 6976 Comparison form follows the ISO 6976 Calculator, like the CV is still in MJ/m^3.

ISO 6976 Comparison

Output	Test6, 14/07/2015 07:47, stream 1, single	Test6, 14/07/2015 07:47, stream 1, MLC	Δ	Δ (percentage)
Z (compressibility)	0.990828	0.990795	0.000034	0.003%
Calorific value	65.967239	66.068835	-0.101597	-0.154%
Molar mass composition	29.810808	29.858652	-0.047844	-0.160%
Wobbe index	64.742211	64.788854	-0.046642	-0.072%
Relative density	1.038201	1.039903	-0.001701	-0.164%
Standard density	1.342314	1.344514	-0.002200	-0.164%

GCAS Desktop displays a warning if the two ISO 6976 Calculators did not have the same base pressure and combustion-metering temperature pair. Correct the mistake in the ISO 6976 Calculator (parent) form, click **Calculate** on the parent form to recalculate using the new pressure or temperature value, and finally click **Refresh** on ISO 6976 Comparison to re-compare.



Output	Test6, 14/07/2015 07:47, stream 1, MLC	Test6, 14/07/2015 07:47, stream 1, single	Δ	Δ (percentage)
Z (compressibility)	0.992355	0.990828	0.001527	0.154%
Calorific value	62.445218	65.967239	-3.522021	-5.640%
Molar mass composition	29.858652	29.810808	0.047844	0.160%
Wobbe index	61.278440	64.742211	-3.463771	-5.653%
Relative density	1.038444	1.038201	0.000242	0.023%
Standard density	1.272519	1.342314	-0.069795	-5.485%

20 ISO 6976 Trend

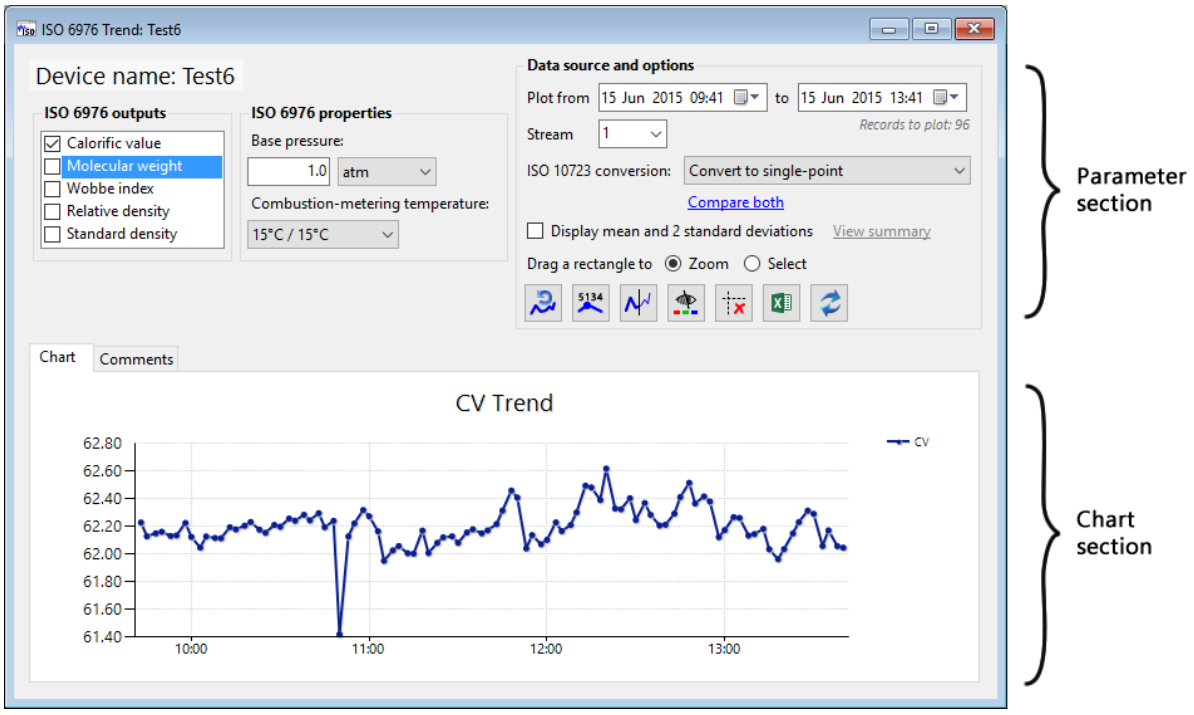
ISO 6976 Trend is a module to plot historical ISO 6976 output values over time. This module should not be confused with Uncertainty Trend which graphs the *uncertainty* of ISO 6976 outputs. ISO 6976 Trend takes a collection of mole composition records and performs ISO 6976 calculation on each of them using the same parameters, and finally displays the trend on a line chart.

Note

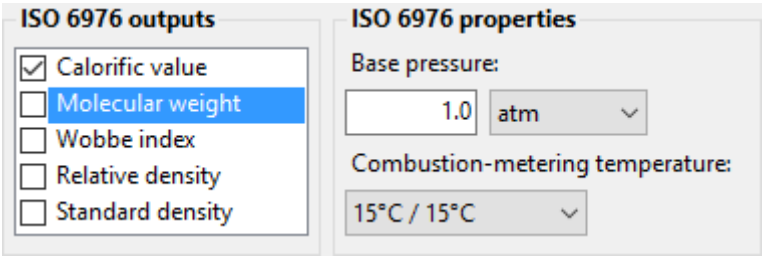
This module will require GCAS feature *ISO 6976 Trend* to be included in your GCAS licence.

20.1 The *ISO 6976 Trend* Form

Select the desired GC device on device panel or recent device panel, and then go to the View menu > **ISO 6976 Trend**. Similar to Data Analysis, ISO 6976 Trend form has three sections: parameters, chart, and comments.



20.2 ISO 6976 Properties

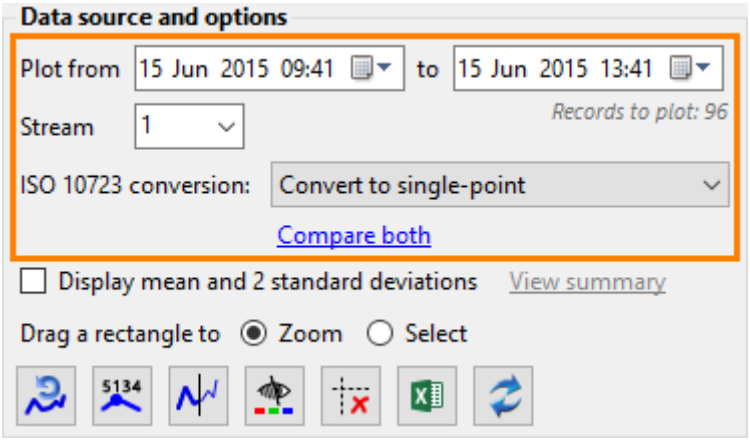


Check boxes on this list controls which ISO 6976 outputs to show. Typically only one output is displayed because values of one ISO 6976 output are far apart from other ISO 6976 outputs.

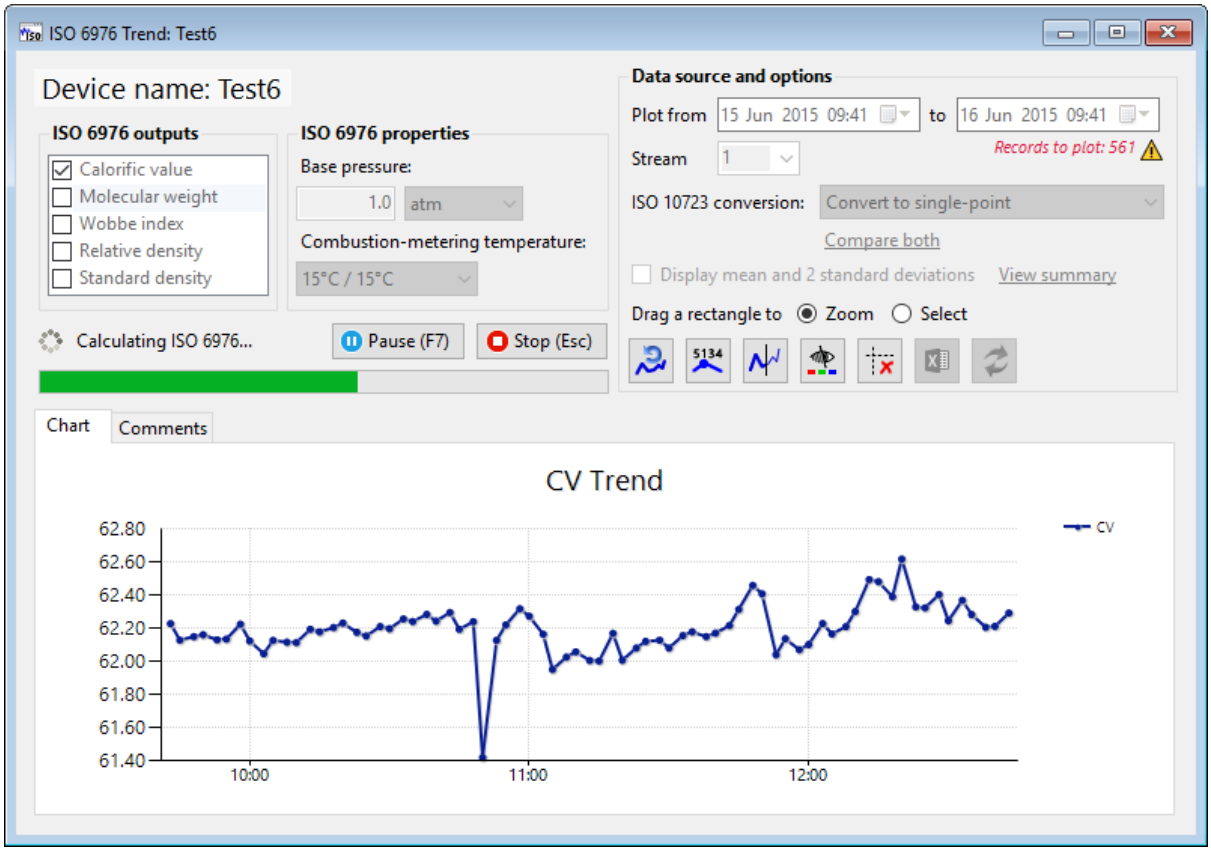
Set the base pressure and the combustion-metering temperature pair. These properties are used to calculate ISO 6976 outputs throughout the entire plot range. Default base pressure is one atmospheric pressure. There are six combustion-metering temperature pairs supported:

- 0°C / 0°C,
- 15°C / 0°C,
- 25°C / 0°C,
- 15°C / 15°C,
- 20°C / 20°C,
- 25°C / 20°C.

20.3 Plot Range and ISO 10723 Conversion



These options control which data source to feed into ISO 6976 calculator inside ISO 6976 Trend. Set the date and time range as well as the stream number and finally click **Refresh** to start graphing. It may take a while to plot the complete chart. GCAS Desktop provides **Pause** button to temporarily halt the operation (or press F7) and **Stop** button (or press Esc) to abort the calculation.



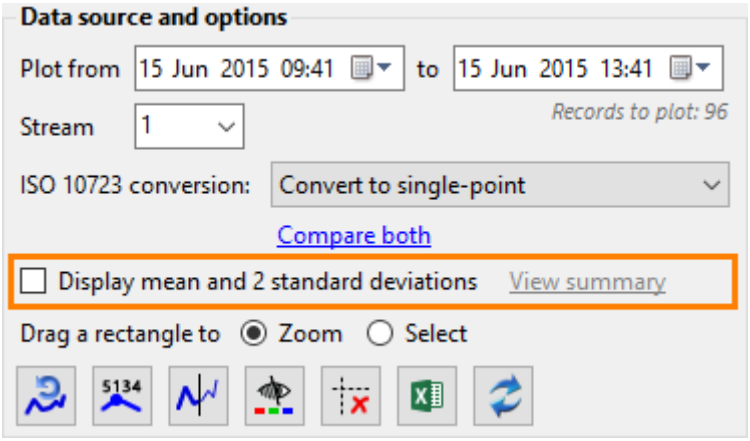
ISO 6976 Trend form, calculation in progress. Dots disappear after 100 data points.

GCAS Desktop determines which stream numbers available based on the existing mole composition records and mole composition streams configuration in Modbus register mappings. Nevertheless if the desired stream number is not listed on this dropdown, just type the number manually and hit **Refresh**.

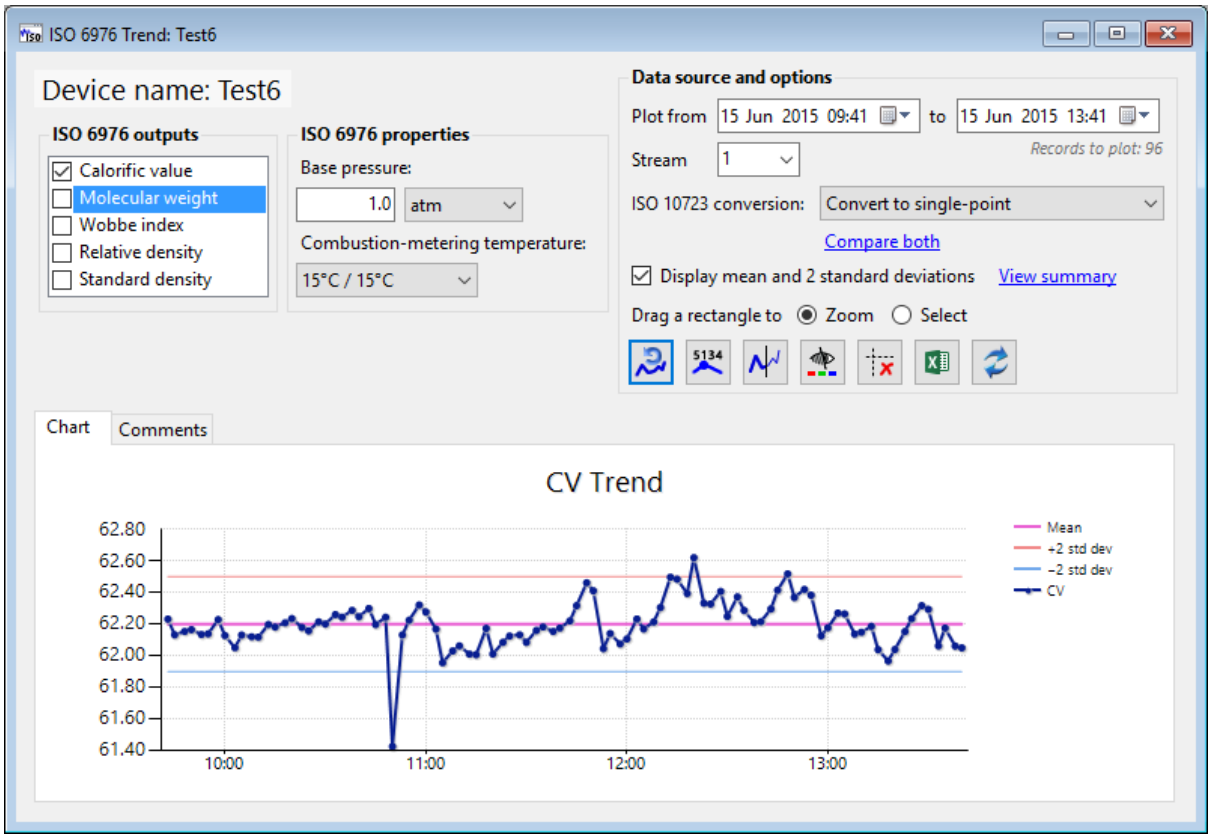
If you have *ISO 10723* feature included in your GCAS licence, you shall see an additional dropdown for ISO 10723 conversion. This dropdown controls whether the underlying mole composition records should be converted to single-point or to multilevel-calibrated values prior to ISO 6976 calculation. Note that non-convertible records will produce gaps on the ISO 6976 trend chart. In addition, you can select **Don't convert** if you have a slow connection and you are confident that the mole composition records are all-single-point or all-MLC. Choosing this option will bypass all ISO 10723 prerequisites which usually takes a long time to load over a slow network.

Under the ISO 10723 dropdown, there is a link named **Compare both**. This link calls ISO 6976 Trend Comparison tool and tells it to compare ISO 6976 trend based on single-point mole composition records versus the trend based on multilevel-calibrated mole composition records. It requires an additional GCAS feature *Data Comparison*.

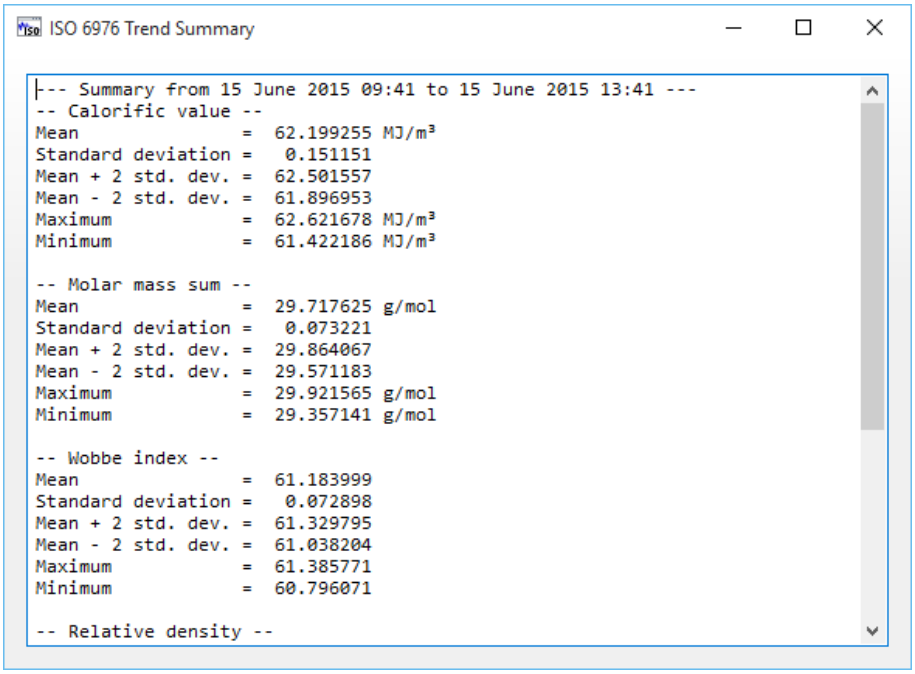
20.4 Mean and Standard Deviations


Data source and options
Plot from 15 Jun 2015 09:41 to 15 Jun 2015 13:41
Records to plot: 96
Stream 1
ISO 10723 conversion: Convert to single-point
Compare both
Display mean and 2 standard deviations View summary
Drag a rectangle to Zoom Select

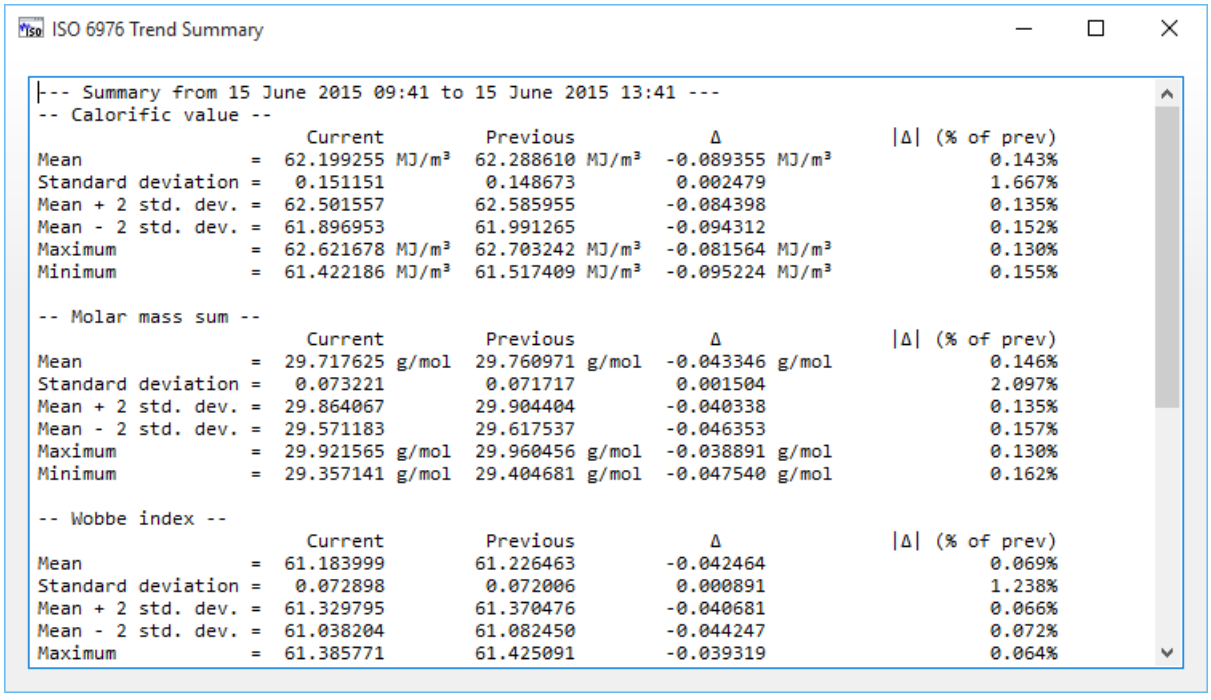
Mean and standard deviations are calculated based on all data points currently appearing on current ISO 6976 trend chart. Tick this check box to reveal the mean and twice the standard deviation lines. GCAS Desktop cannot show mean and standard deviation lines for previous chart, they are for current chart only. Mean and standard deviations will not show if there are multiple ISO 6976 output trends in the chart.



Next to the check box, you see a link called **View summary**. This link generates statistical summary for the entire X-axis. To generate summary on a certain portion of X-axis, switch to selection mode and use the right-click menu instead.

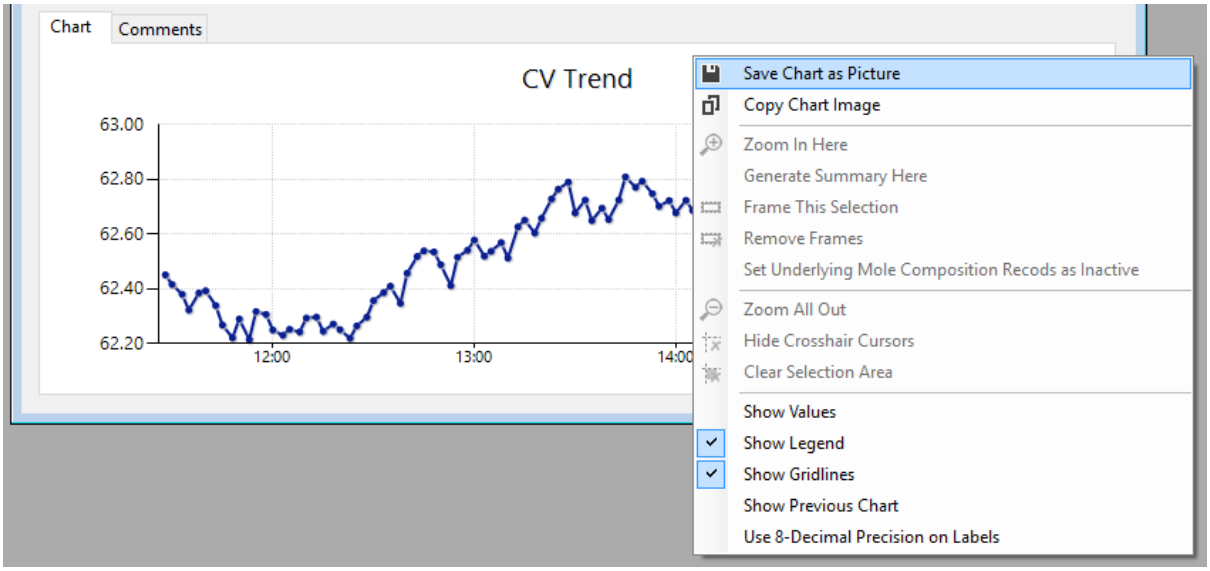

ISO 6976 Trend Summary
--- Summary from 15 June 2015 09:41 to 15 June 2015 13:41 ---
-- Calorific value --
Mean = 62.199255 MJ/m³
Standard deviation = 0.151151
Mean + 2 std. dev. = 62.501557
Mean - 2 std. dev. = 61.896953
Maximum = 62.621678 MJ/m³
Minimum = 61.422186 MJ/m³
-- Molar mass sum --
Mean = 29.717625 g/mol
Standard deviation = 0.073221
Mean + 2 std. dev. = 29.864067
Mean - 2 std. dev. = 29.571183
Maximum = 29.921565 g/mol
Minimum = 29.357141 g/mol
-- Wobbe index --
Mean = 61.183999
Standard deviation = 0.072898
Mean + 2 std. dev. = 61.329795
Mean - 2 std. dev. = 61.038204
Maximum = 61.385771
Minimum = 60.796071
-- Relative density --

Note if you opted to show previous chart as well, this summary includes the difference between current chart and previous chart.



20.5 Save or Copy the Chart

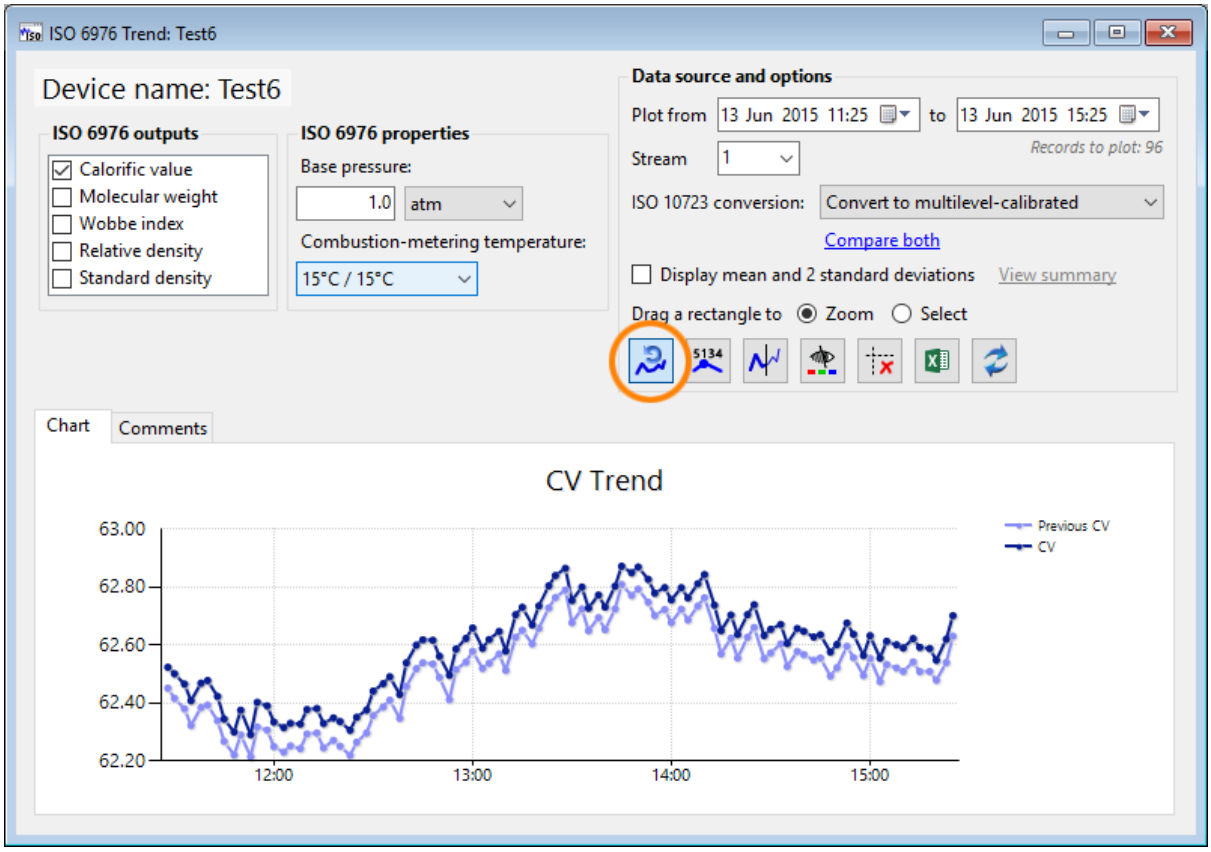
To save the chart as image file, right click on the chart and select **Save Chart as Picture**.



Similarly to copy the chart into clipboard, right click and select **Copy Chart Image**. Then you may paste the image onto Microsoft Paint, Microsoft Word, or any software that accepts bitmap image.

20.6 Comparing Previous Chart

ISO 6976 Trend form remembers the last ISO 6976 trend chart before you changed something. By this way, you can quickly compare current ISO 6976 trend versus the one before parameter change. Typical use of previous chart is to compare calorific value (CV) based on single-point mole compositions versus CV based on multilevel-calibrated mole compositions. To do so, first graph ISO 6976 trend with ISO 10723 dropdown set to **single-point**. Next, change the ISO 10723 option to **multilevel-calibrated** and hit **Refresh** to graph the ISO 6976 trend on MLC. Finally, click **Show previous chart** button. Current chart (dark blue) is the CV based on MLC compositions, while previous chart (light blue) is the CV based on single-point compositions.

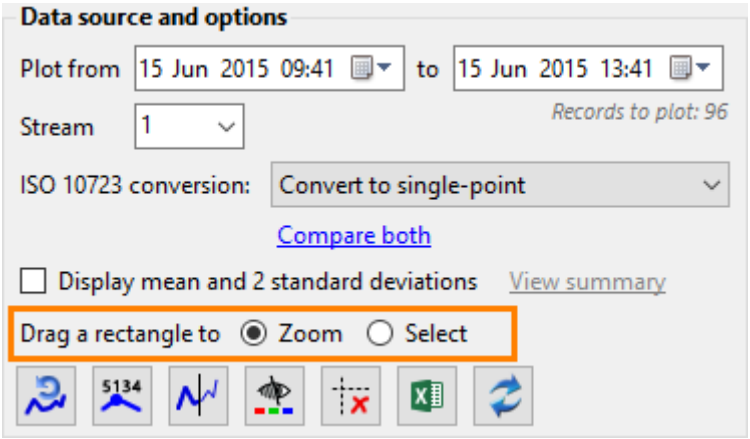


Example of a bad GC. Current CV (dark blue) is based on multilevel-calibrated compositions, while previous CV (light blue) is based on single-point compositions. If these two drift too far apart, this indicates problems within the GC. A good GC should have these two be really close or even co-incide.

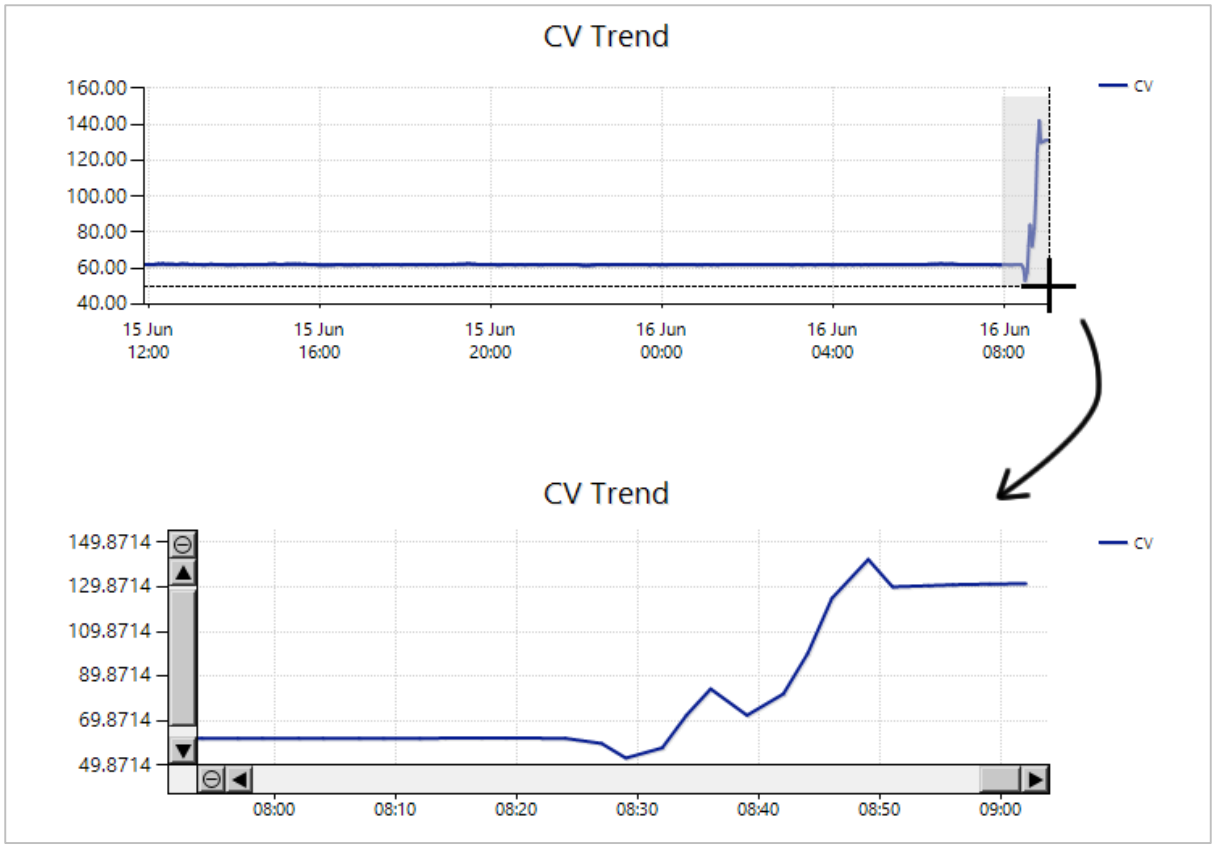
Be reminded that only one previous chart is cached. If you change a parameter the third time, first chart graphed is lost when you click **Refresh**.

20.7 Zoom Mode and Selection Mode

These radio buttons control whether ISO 6976 Trend form is in zoom mode or in selection mode.

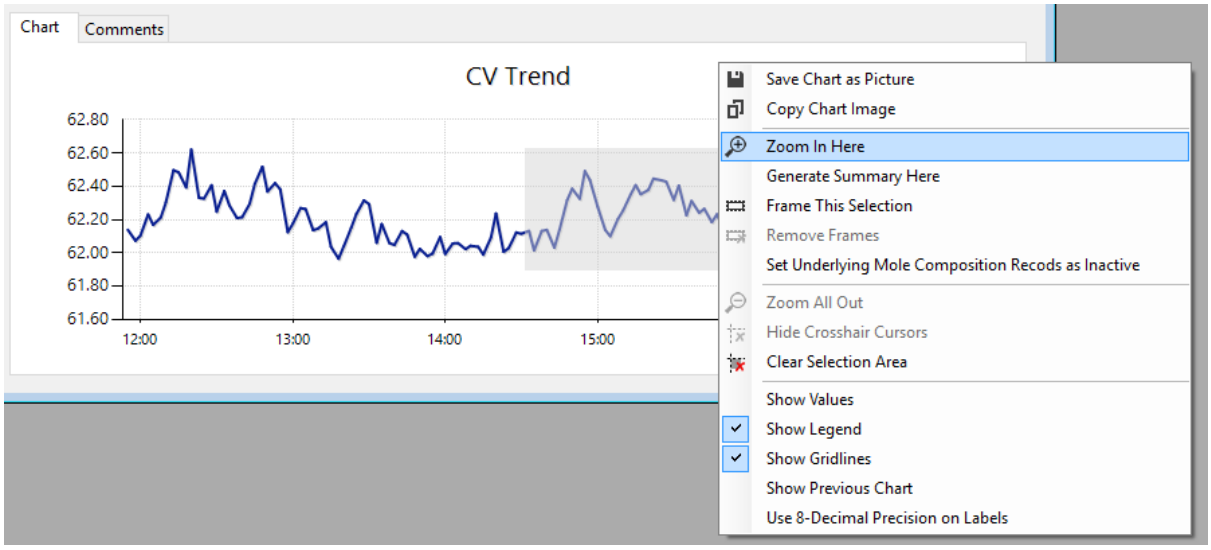

Data source and options
Plot from 15 Jun 2015 09:41
to 15 Jun 2015 13:41
Records to plot: 96
Stream 1
ISO 10723 conversion: Convert to single-point
Compare both
Display mean and 2 standard deviations
View summary
Drag a rectangle to Zoom Select

In *zoom mode*, drag a rectangle on a region you would like to zoom.



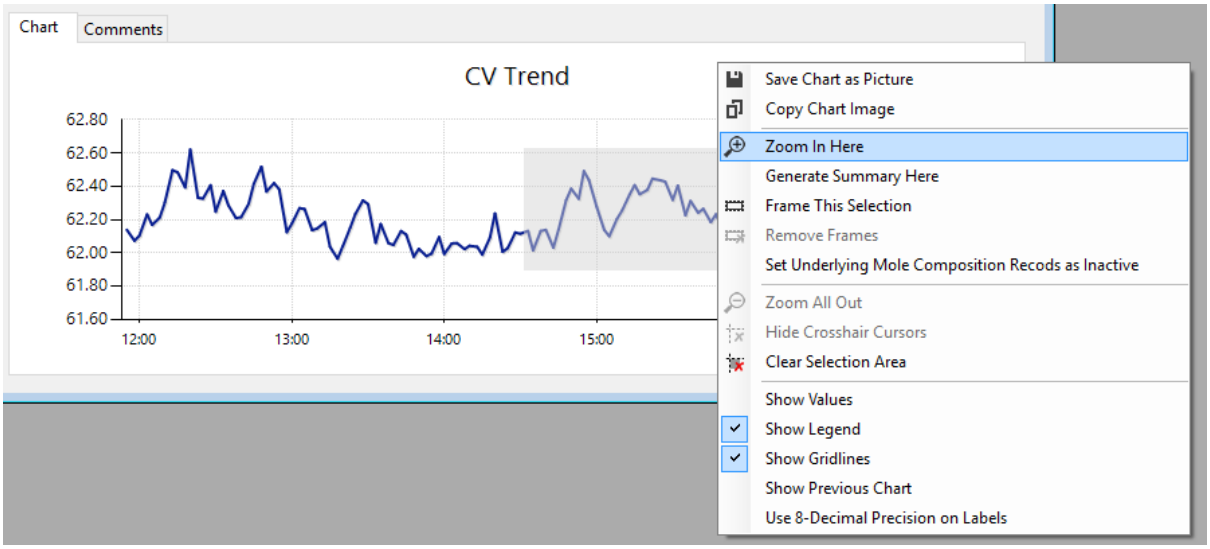
Pan the chart using the provided scroll bars. Drag another rectangle to zoom in further. To zoom out one step, click on the circled minus button ⊖ on both scroll bars. To zoom all-out, simply press the Home button on your keyboard or right-click on the chart and select **Zoom All Out** submenu.

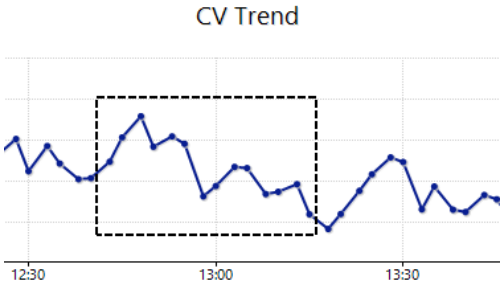
In *selection mode*, drag a rectangle to create a selection area. Right click the chart and you see several menus are now available. Chapter 20.8 Selection Mode Menus will explain the function of each menu. To clear selection area, right click the chart and select **Clear Selection Area**.



20.8 Selection Mode Menus

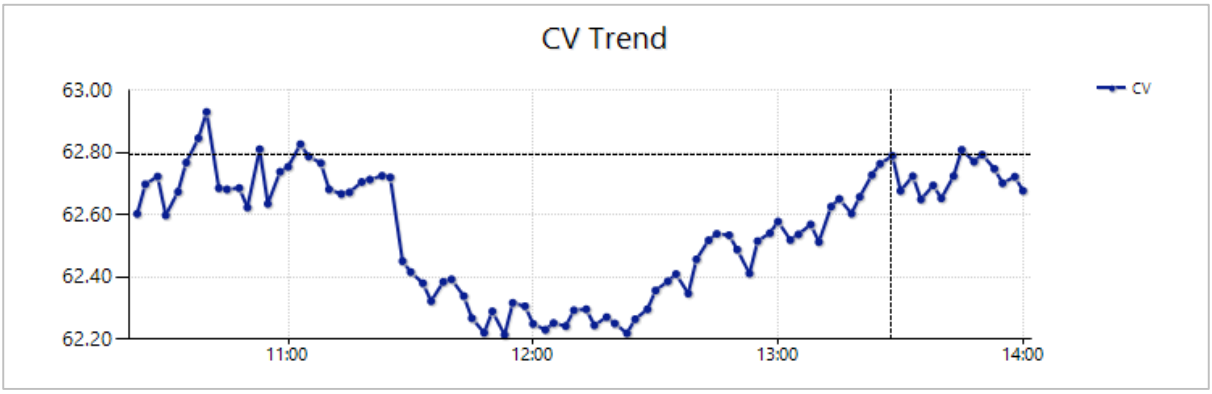
Assuming the chart is on selection mode and you have a selection rectangle, these menus are available.



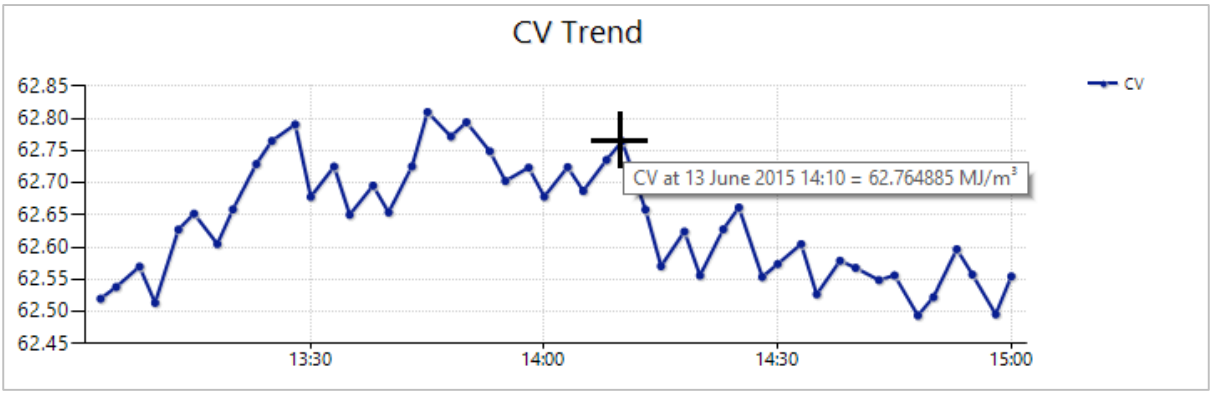
Menu	What it does
Zoom In Here	Zooms in to the selection rectangle.
Generate Summary Here	Generates statistical summary for all data points inside the selection rectangle. - If you activate previous chart alongside current ISO 6976 trend chart, the summary also includes differences between the two. - GCAS Desktop looks at the X-axis range only. Data points excluded by the selection rectangle (having Y-axis values outside of selection rectangle) are also included for statistical calculation.
Frame This Selection	Literally puts a rectangular frame around the selection area, for presentation purpose only. 
Remove Frames	Removes all rectangular frames created through *Frame This Selection* menu.
Set Underlying Mole Composition Records as Inactive	As it says, this menu sets all underlying mole composition records within the selection area as inactive. Once it's done, the ISO 6976 trend chart will have a gap on it and the mean/standard deviation values are invalidated. Refresh the chart to get the correct values.

20.9 Other Visual Cues

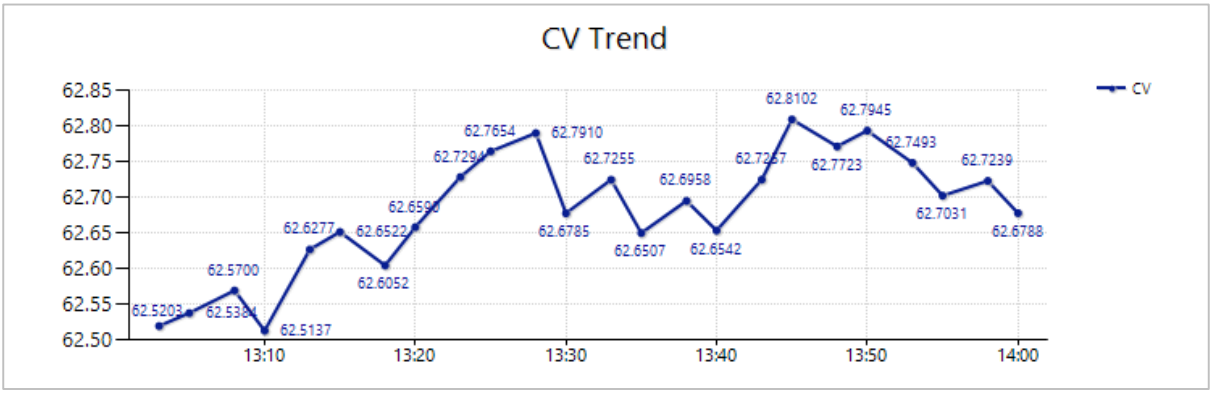
Set the chart to zoom mode. Click anywhere on the chart to place these *crosshair cursors*. These dotted pair of line acts as a ruler to compare Y-axis values between several data points. To remove them, click **Hide crosshair cursors**.



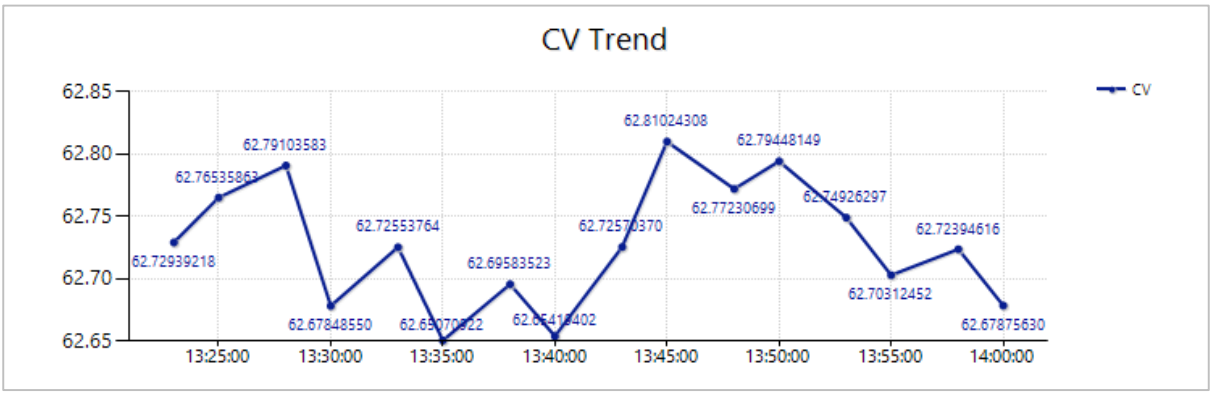
Hover your mouse pointer over a data point to show a tooltip about its value.



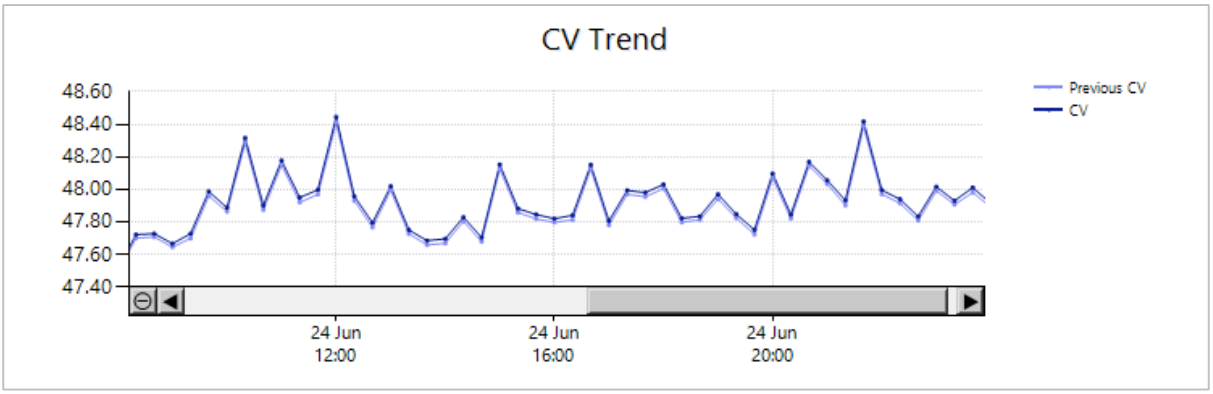
Or click **Show values** to display values on labels.



If you need higher precision, right click the chart and tick **Use 8-Decimal Precision on Labels**. Untick this menu to revert back to 4-digit decimals.

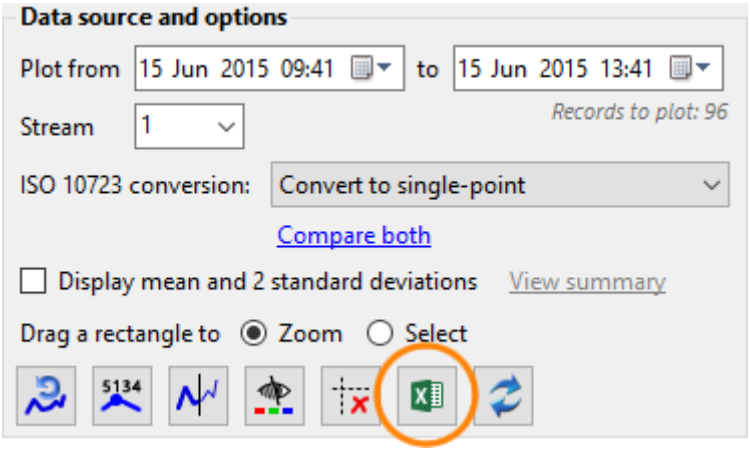


In case of current ISO 6976 line and previous ISO 6976 line are so close together, click **Use thin lines** to draw the chart using 1-pixel width lines.



20.10 Export Values to Microsoft Excel

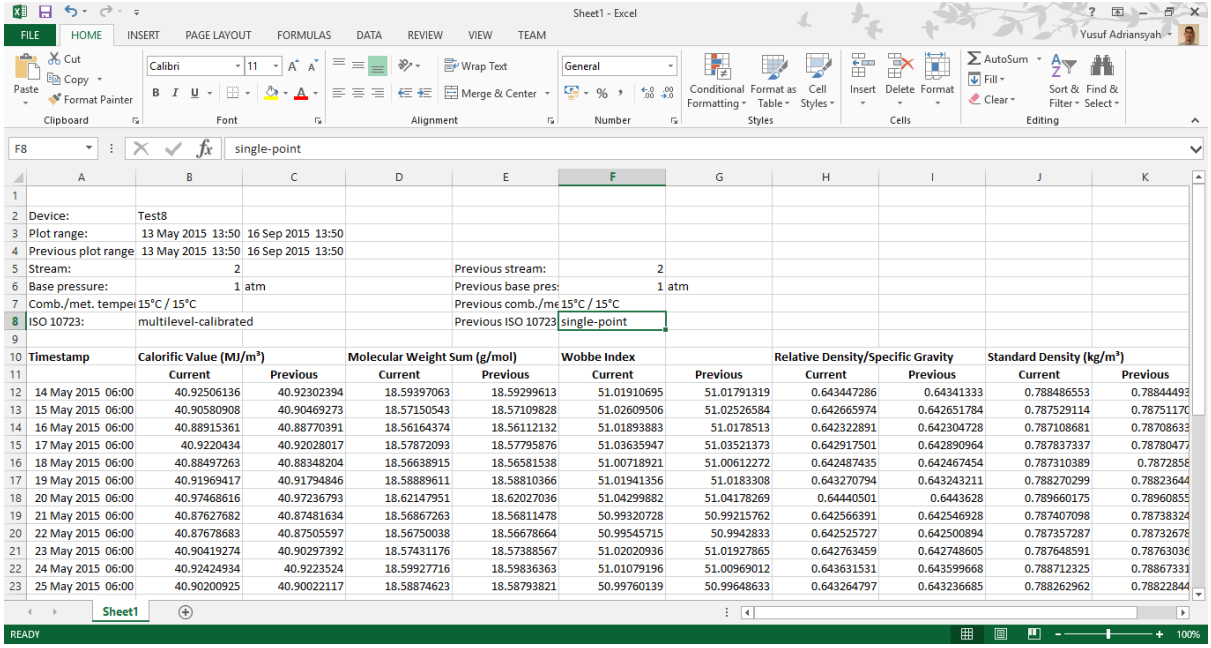
Once the chart has been graphed completely, click **Copy to Microsoft Excel**. This button opens a new Excel worksheet. Then GCAS Desktop writes all data points of all line charts onto this worksheet.


Data source and options
Plot from 15 Jun 2015 09:41
to 15 Jun 2015 13:41
Records to plot: 96
Stream 1
ISO 10723 conversion: Convert to single-point
Compare both
Display mean and 2 standard deviations
View summary
Drag a rectangle to Zoom Select
5134

Note

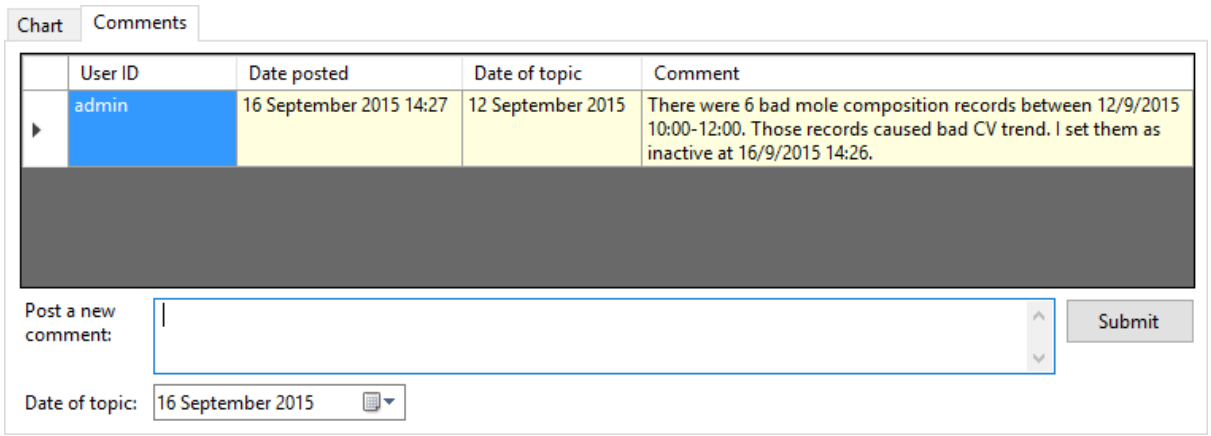
This feature requires Microsoft Excel 2010, 2013, 2016 or later, to be installed.

GCAS Desktop writes all five ISO 6976 outputs to Microsoft Excel worksheet—both current ISO 6976 trend and previous ISO 6976 trend values. If there is no previous chart graphed before, previous ISO 6976 trend values are all blanks. No worries, you can export to Microsoft Excel even if current ISO 6976 trend chart has a different date/time range than the previous chart.



20.11 Insert Comment

To view or write comments, open the **Comments** tab.



Write your comment and set the appropriate date of topic, then click **Submit**. Your comment will have a yellow background to distinguish it from comments by other users. **Date of topic** is an additional information of which mole composition record you are writing your comment for, thus other users know the correct data point to refer to.

Make sure that the comment is correct e.g. free from spelling errors, because once submitted you would not be able to edit nor remove your comment.

To refresh comments, click the same **Refresh** button.

If you do not see the text box to write your comment, i.e. you only see the comment grid, your GCAS user account doesn't have the action permission to write comment in ISO 6976 trend. Contact your GCAS administrator.

21 ISO 6976 Trend Comparison

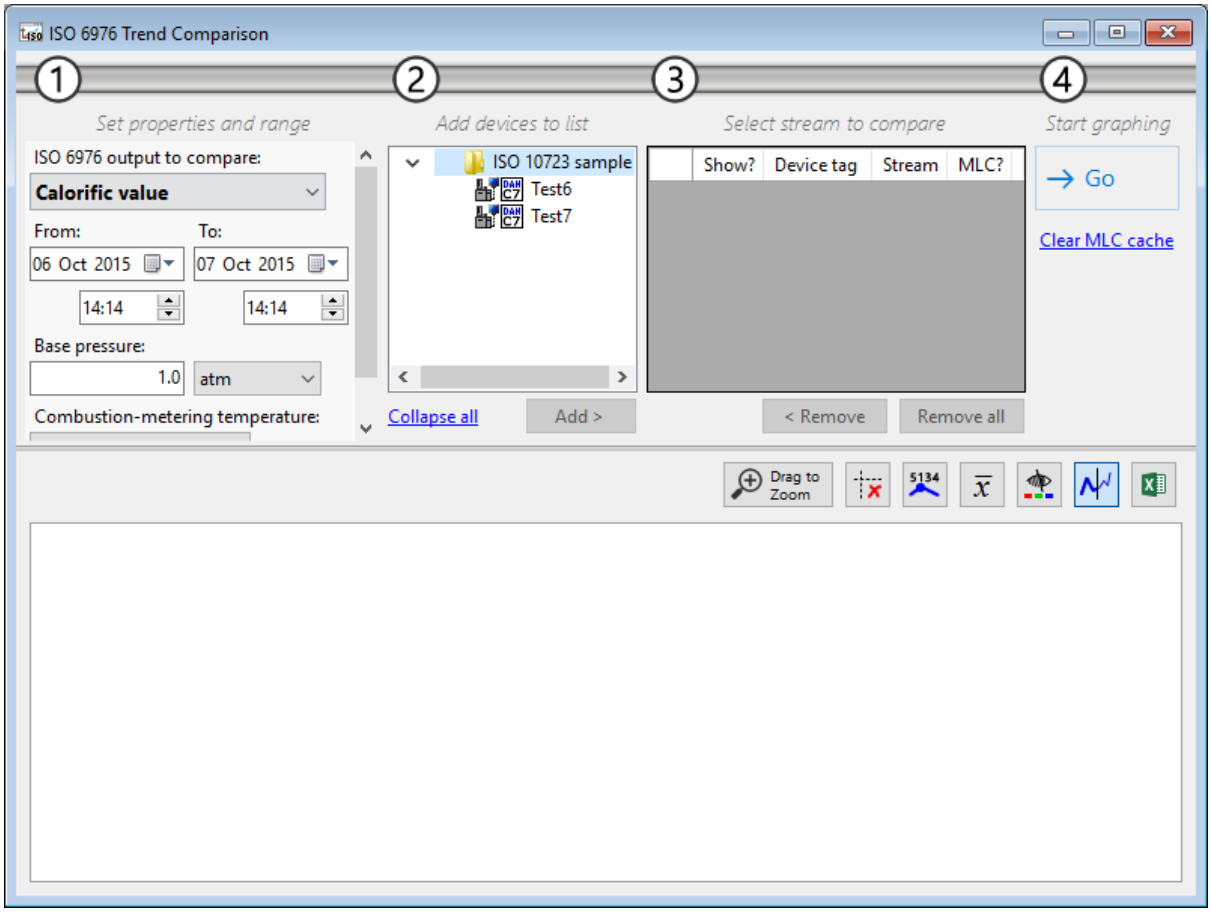
ISO 6976 Trend Comparison is a tool to compare ISO 6976 trends across devices. It is a part of *Data Comparison* feature, which stands in line after Mole Composition Comparison. Do not confuse ISO 6976 *trend* comparison with ISO 6976 comparison. The former is what we are going to talk in this chapter, while the latter is a bonus feature of ISO 6976 Calculator.

Note

This module requires two GCAS features to be included in GCAS licence: *ISO 6976 Trend* and *Data Comparison*.

21.1 The *ISO 6976 Trend Comparison* Form

To open ISO 6976 Trend Comparison form, go to the Tools menu > **ISO 6976 Trend Comparison**.

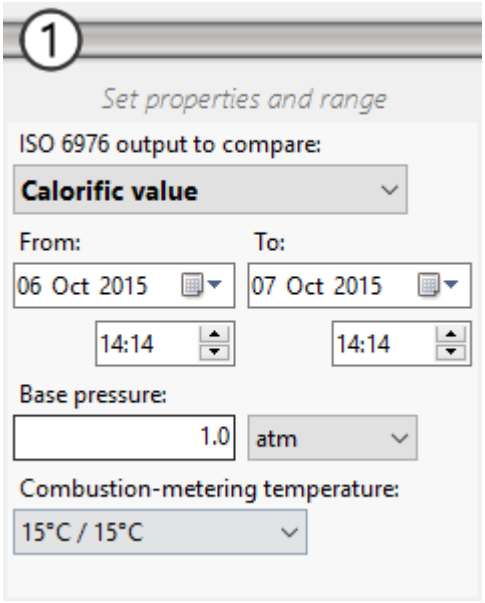


Similar to Mole Composition Comparison form, ISO 6976 Trend Comparison form has two resizable sections. Parameters are at the top, chart is at the bottom. This form is designed with similar UI experience with Mole Composition Comparison therefore users can use it straight away without reading this chapter further.

21.2 Parameters and Device List

The top section of the form has a linear flow. Select what ISO 6976 output you need, the comparison date range, and ISO 6976 properties (❶), then browse the devices to compare (❷) and add them to the comparison list (❸), select which stream of these devices (❸) and finally click **Go** (❹) to start graphing.

21.2.1 Plot Range and ISO 6976 Properties

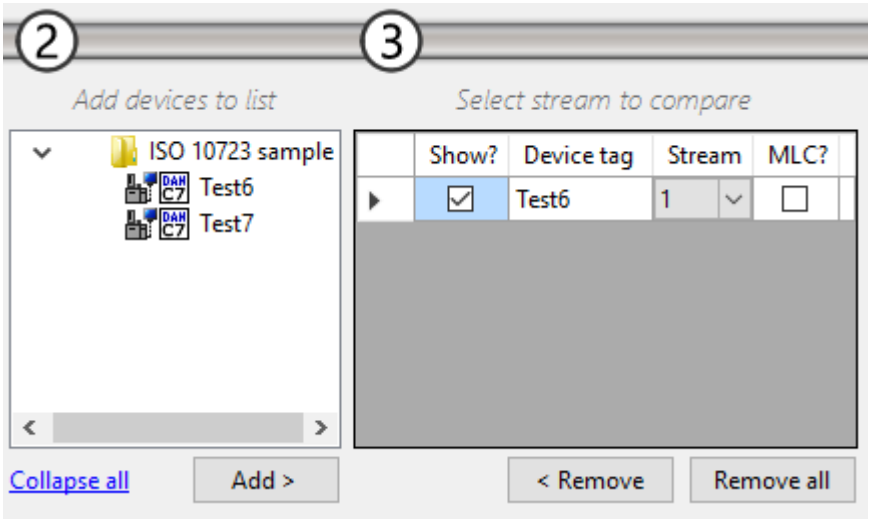


First thing first, select which ISO 6976 output to compare. The default selection is calorific value (CV), but other options are molar mass sum, Wobbe index, relative density, and standard density. Going down, there are date and time pickers to set the plot range. Scroll down once more and you see the ISO 6976 properties (base pressure and combustion-metering temperature pair).

Default base pressure is the atmospheric pressure (1 atm). GCAS Desktop supports six combustion-metering temperature pairs, which are

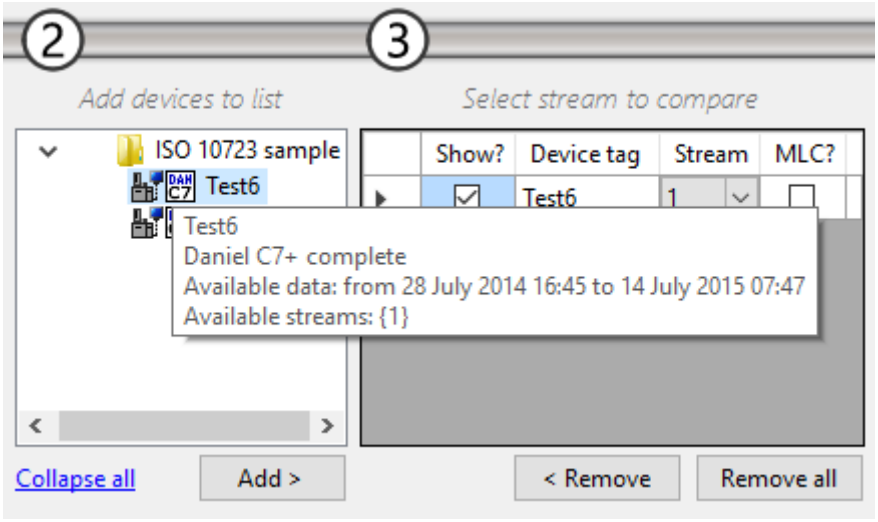
- 0°C / 0°C
- 15°C / 0°C (combustion temperature = 15°C, base temperature = 0°C)
- 25°C / 0°C
- 15°C / 15°C (the default)
- 20°C / 20°C
- 25°C / 20°C

21.2.2 Devices and Comparison List



Device tree view is on the left. It lists all your workspaces and devices within each workspace. The grid on the right is known as *comparison list*.

Hover your mouse pointer over a device to view more information about data availability and stream numbers. In the screenshot below, the device Test6 has only one stream number: stream 1. ISO 6976 calculation is based on mole composition records, hence devices which don't have mole composition records at all are displayed as semi-transparent and cannot be added to the comparison list.



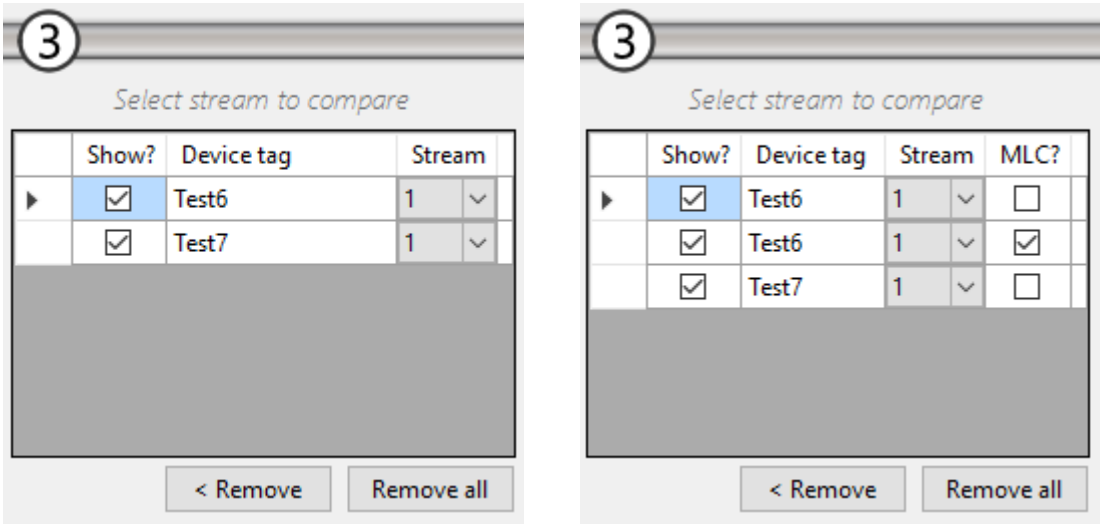
To compare devices, add the devices from the device tree view to the comparison list. Either select the device then click **Add**, or double click the device, or drag the device and drop it onto comparison list.

Note

An ISO 6976 Trend Comparison form which was opened via *Send to* shortcut from Mole Composition Comparison's *Send to ISO 6976 Trend Comparison* button or right-click menu, as well as through the *Compare both* link on ISO 6976 Trend form; is locked to a certain number of comparison entries. Device tree view is empty and you cannot add another device into comparison list. The text above the

chart should clearly indicate the form is locked. Click **Reset and reload device list** next to this text in order to unlock ISO 6976 Trend Comparison form back into normal mode.

Once the device has been added to the comparison list, select the stream number. ISO 6976 Trend Comparison form reads the mole composition records for this stream number. You can compare ISO 6976 trend values coming from different streams of the same device too. To do so, add the device to the comparison list twice, then select different stream number for each of them. Moreover if you have *ISO 10723* feature in your GCAS licence, this tool can also compare the ISO 6976 trend values based on single-point composition vs. multilevel-calibrated composition of the same device, same stream number.



Example of comparison list for users without ISO 10723 (left) and with ISO 10723 (right).

The column **Show?** contains check boxes which is used to hide or show the line chart of corresponding comparison entry after the chart has been rendered completely. Before you click **Go**, these check boxes have no effect.

Users with GCAS feature *ISO 10723* in their GCAS licences see an additional column named **MLC?** which also contains check boxes. This is the single-point/MLC switch. Tick the check box to graph ISO 6976 trend based on multilevel-calibrated composition, otherwise leave it unticked to graph ISO 6976 trend based on single-point composition.

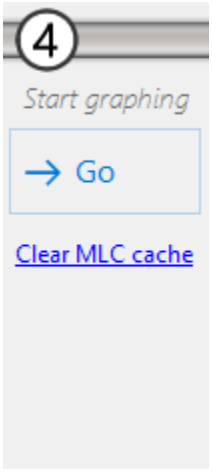
To remove an entry from the comparison list, highlight its row on the grid and then click **Remove** or press `Delete` on your keyboard. Everytime a comparison entry is removed from the comparison list, its line chart is also removed. However if you add it back, you need to redraw the chart because its data in the cache has already gone. This is the difference between removing an entry versus temporarily hiding it (by unticking the check box inside the **Show?** column). In addition, click **Remove all** to empty the comparison list and start over.

Note

Maximum number of entries in comparison list is 15 entries.

GCAS Desktop will alert you if there are duplicate comparison entries. A *duplicate* means same GC device + same stream number [+ same MLC/single-point switch if you have *ISO 10723*].

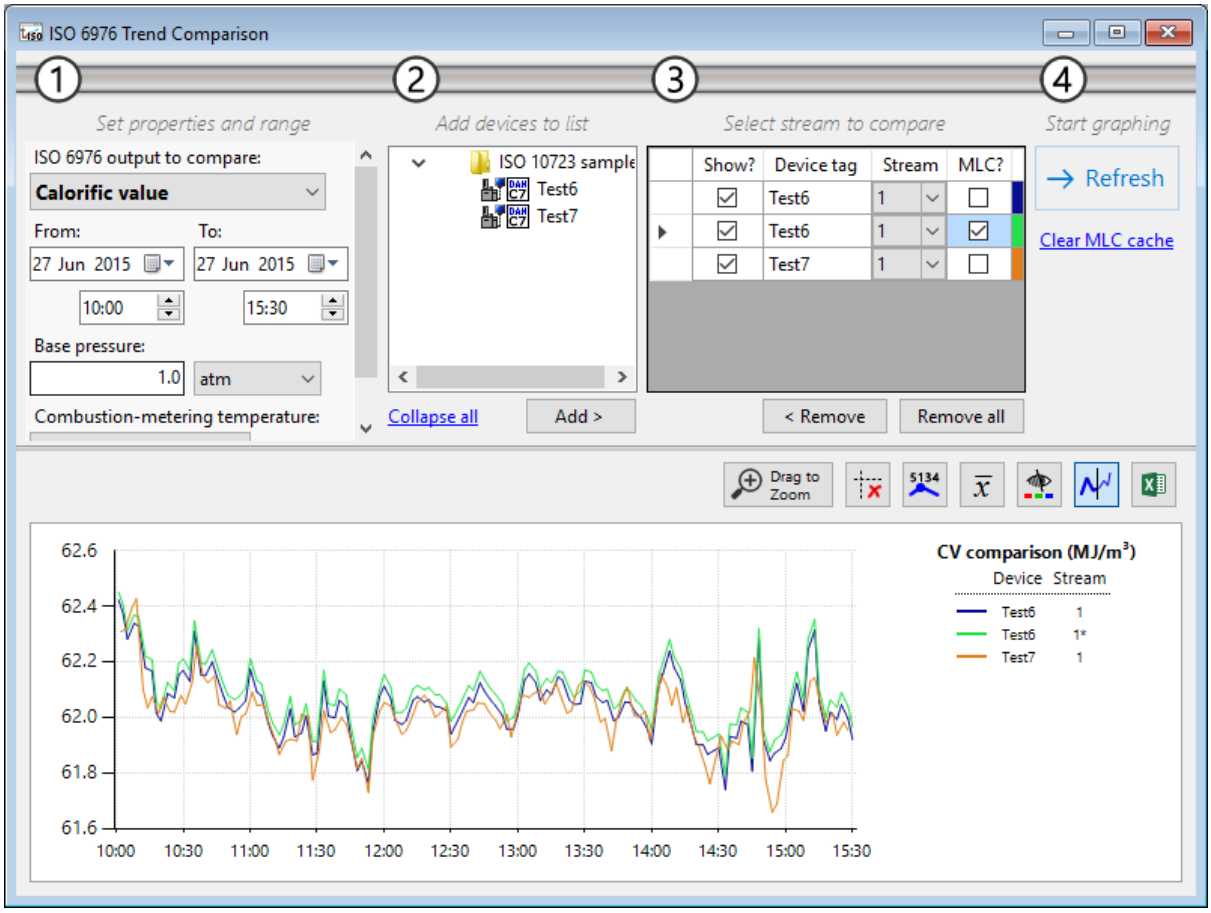
21.2.3 Start Graphing



When you are ready, click **Go**. GCAS Desktop loads the required mole composition data, calculates their ISO 6976 values, and renders the chart. The **Go** button turns into **Refresh** button unless you change the selected ISO 6976 output, ISO 6976 properties, comparison date range, devices, stream numbers, or single-point/MLC switch.

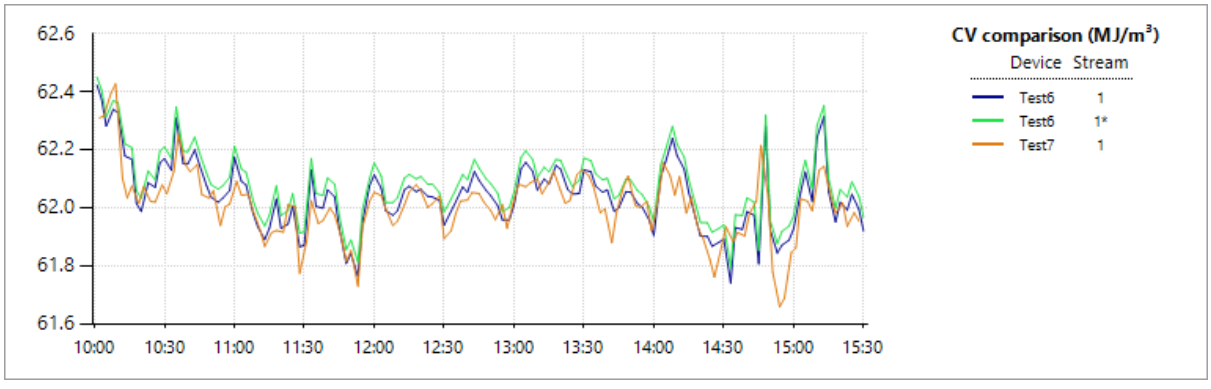
Users with *ISO 10723* feature in their licences see an additional command link **Clear MLC cache**. This clears the cache used by ISO 10723 conversion. The cache contains MLC coefficients, calibration certificates, single-point RF, MLC RF, and MLC constraints. Click this link if you notice the ISO 6976 trends based on multilevel-calibrated streams are not correct. Once the MLC cache is emptied, refresh the chart.

The chart legend lists the device tag name and the stream numbers. Multilevel-calibrated streams are indicated with asterisk (*) after stream number similar to the green line in this screenshot example.



21.3 Comparison Chart

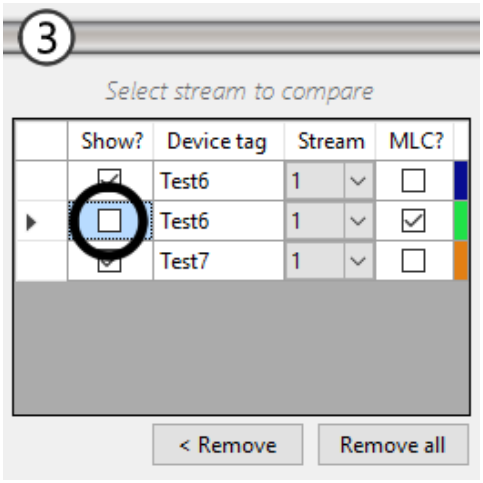
The chart graphs ISO 6976 output values based on mole composition records over time. This chart has maximum capacity of 15 comparison entries. The legend at your right hand side tells the devices and their stream numbers. Multilevel-calibrated streams (ISO 10723) are indicated with asterisk (*) after their stream numbers.



By default, GCAS Desktop draws the chart using thin lines, unlike all other charts in GCAS Desktop which use 2-pixel width. Line charts having data points less than 100 have small dot markers along its body. Line charts with more than 100 dots are presented without markers like similar to screenshot above.

21.3.1 Show or Hide Some Devices

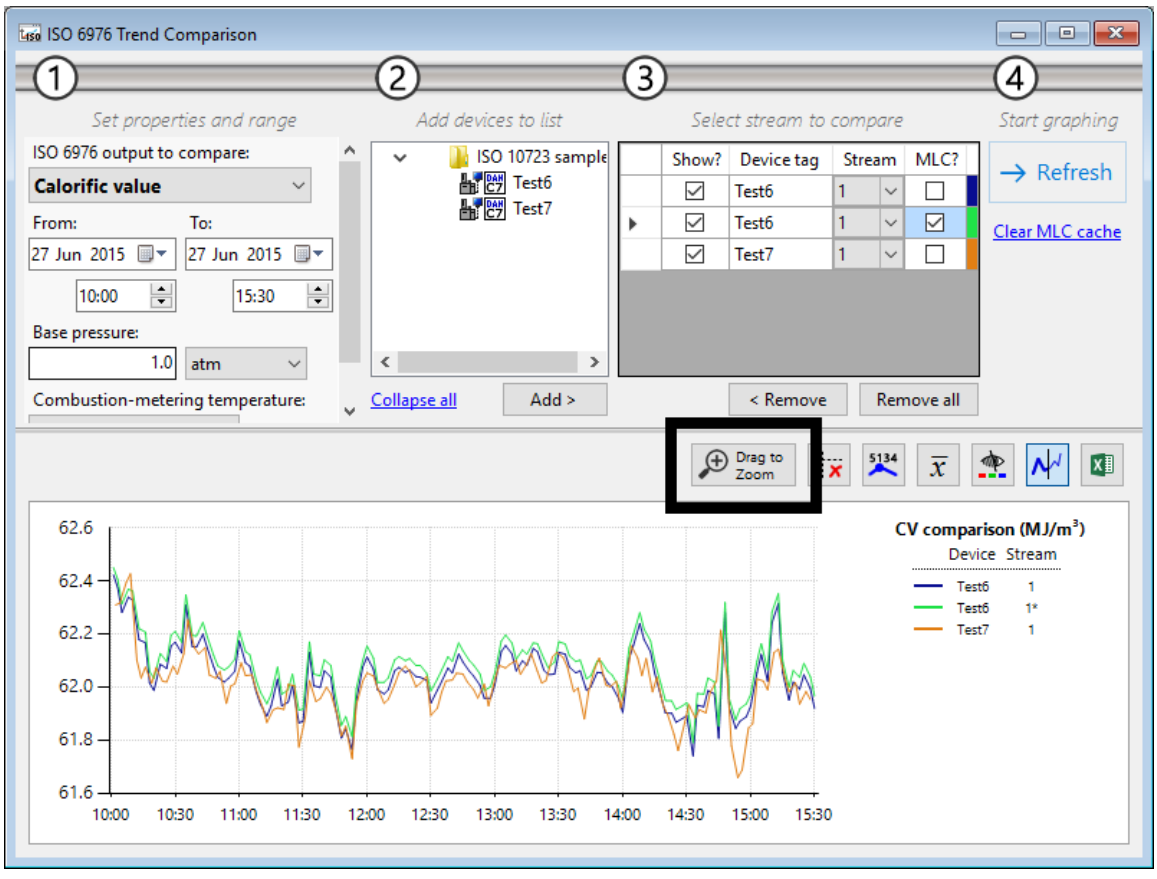
To temporarily take a comparison entry off the chart, untick its check box at the column **Show?** inside the comparison list. Check the check box to bring the line visible.



If you *remove* a device or stream from this list, its line chart is also removed. After you add the device or stream back, you need a full refresh to redraw the lost line.

21.3.2 Zoom Mode and Selection Mode

Click this button to switch between *zoom mode* and *selection mode*.

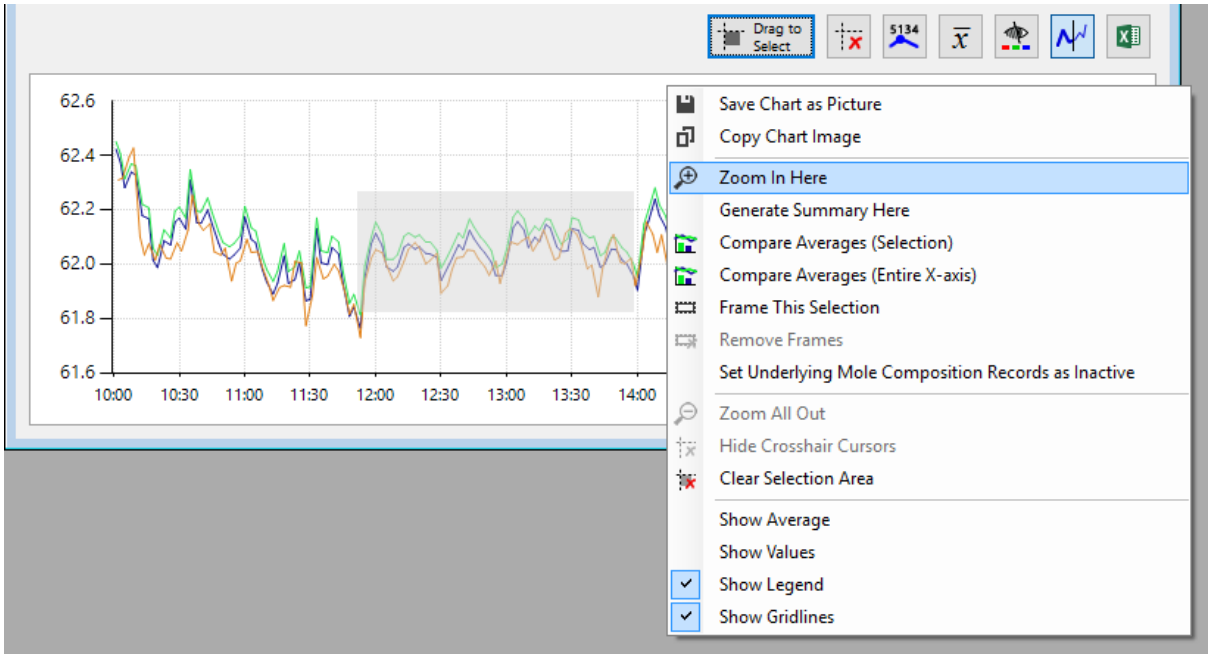




Toggle button to switch between zoom or selection mode.

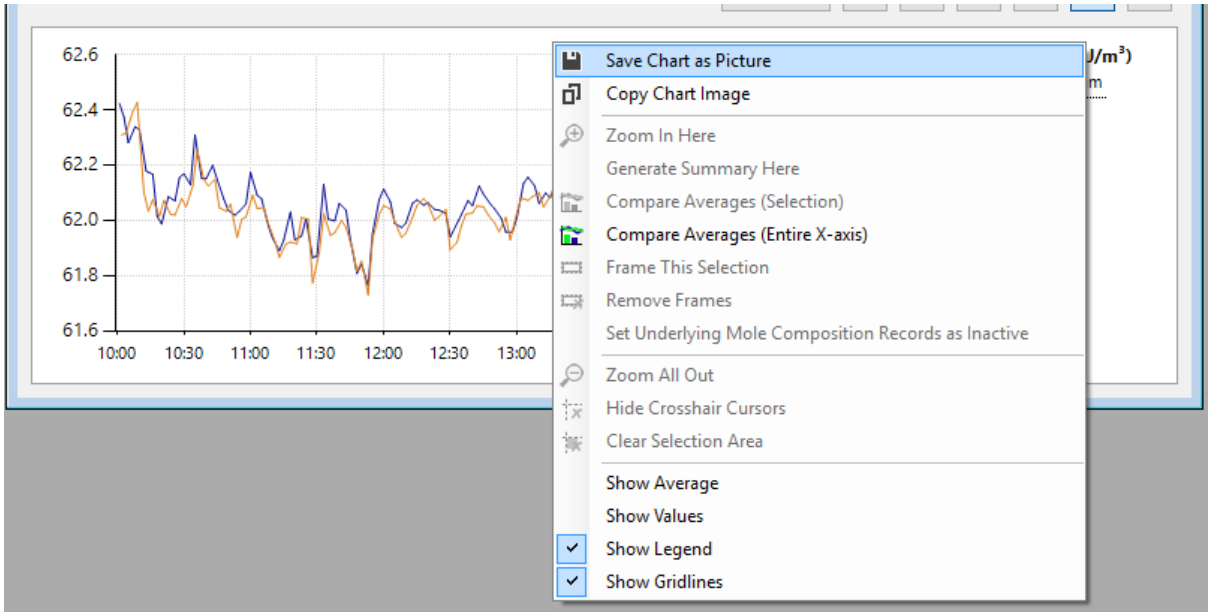
Zoom mode enables zooming to a specific area of the chart. Drag a rectangle over the area you want to zoom in. Pan around the chart using the provided scroll bars. Drag another rectangle to zoom in further. To zoom out, click the circled minus button ⊖ on both scroll bars. Press Home on your keyboard or right click the chart and select **Zoom All Out** to undo all zoom-in operations.

Selection mode lets you create a selection area on the chart, then makes some context menu available to manipulate the data inside this selection area. Chapter 21.3.5 explains the function of each menu. To clear selection area, right click the chart and select **Clear Selection Area**.



21.3.3 Save or Copy the Chart

To save the chart as image file, right click the chart and select **Save Chart as Picture**. Or if you prefer copying the image directly onto Microsoft Power Point for example (or any software accepting bitmap image), right click the chart and select **Copy Chart Image**.



21.3.4 Export Values to Microsoft Excel

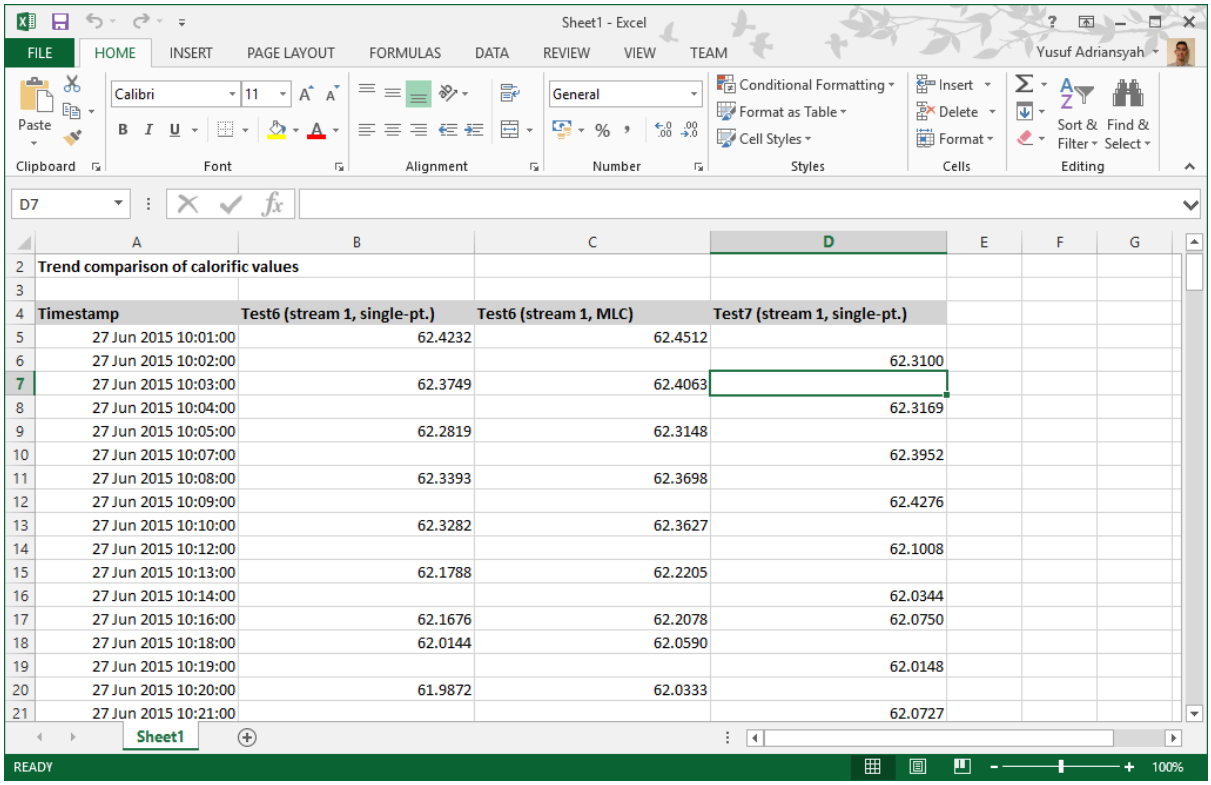
Above the chart, located at the rightmost button, click **Copy to Microsoft Excel**. This button opens a new Excel worksheet. Then GCAS Desktop writes all data points of all line charts available onto this worksheet.

Note

This feature requires Microsoft Excel 2010, 2013, 2016 or later, to be installed.

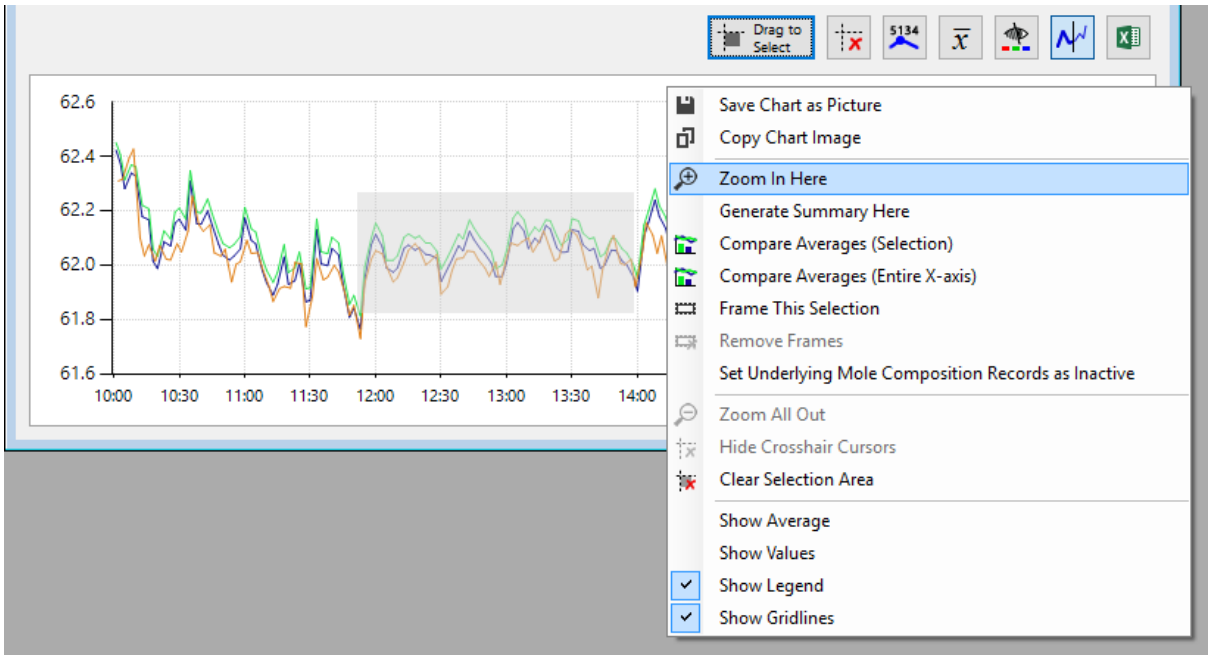
GCAS Desktop prevents you from exporting to Excel if there are duplicate comparison entries.

Every device or stream in comparison list has its own column and the rows are timestamps. If there are two or more data points from different devices or streams sharing the exact same timestamp, they are merged into one row in Excel worksheet.



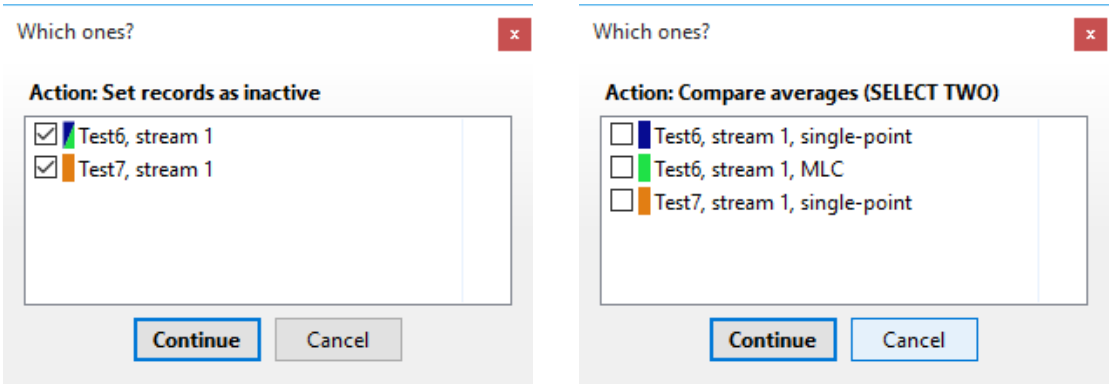
21.3.5 Selection Mode Menus

These menus are available if ISO 6976 Trend Comparison form is in selection mode and there is a valid selection rectangle on the chart. Similar to Mole Composition Comparison, ISO 6976 Trend Comparison requires a *contiguous* selection area. If there are several data points leaking out of your selection rectangle, GCAS Desktop alerts you while proposing a new selection area.



Menu	Function
Zoom In Here	Zooms in to the selection area.
Generate Summary Here	Generates statistical summary for the selected area.
Compare Averages (Selection)	Prompts you to select two comparison entries out of whichever available inside the selection area; then compares the average of the two, giving you the delta and difference in percentage. See chapter 21.3.6 for details.
Compare Averages (Entire X-axis)	Prompts you to select two comparison entries out of all lines available on the chart; then compares the average of the two, giving you the delta and difference in percentage. This menu does not even need a selection area. See chapter 21.3.6 for details.
Frame This Selection	Literally puts a rectangular frame around the selection, for presentation purpose. This works on the average chart too.
Remove Frames	Deletes all frames created through *Frame This Selection* menu.
Set Underlying Mole Composition Records as Inactive	As ISO 6976 calculation is based on mole composition records, this menu sets the underlying mole composition records contained inside the selection area as inactive. You need to refresh the chart afterwards. If your selection rectangle covers more than one line chart, GCAS Desktop prompts you to select which ones to set as inactive.

These menus **Compare Averages** (both of them) and **Set Underlying Mole Composition Records as Inactive** may display a confirmation dialogue like the ones below. Setting mole composition records as inactive should merge a pair of single-point and MLC entries of the same device same stream number into one entity. Average comparison requires you to select exactly two entries.



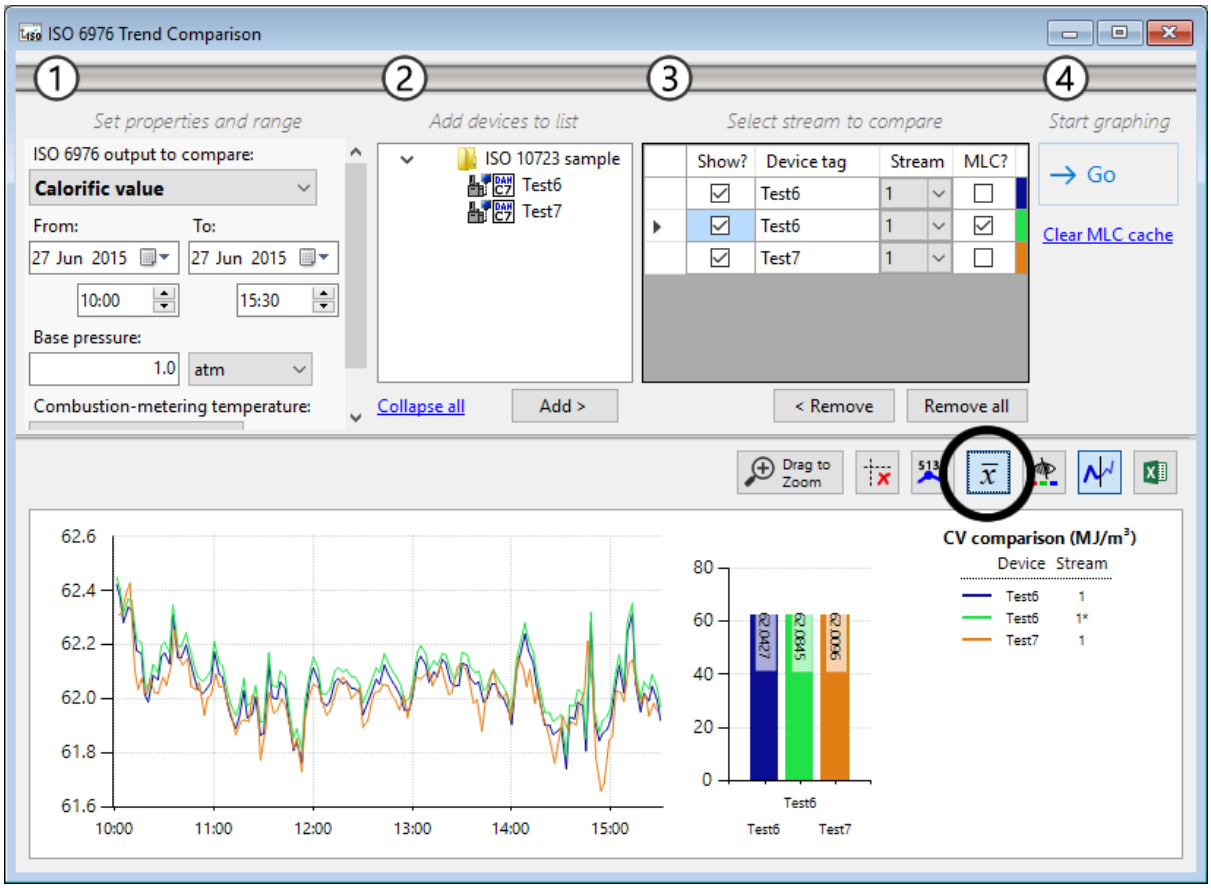
Confirmation dialogue boxes. (Windows 10 does not render form border for small dialogues)

21.3.6 Comparison of Averages

21.3.6.1 The 'Average' Chart

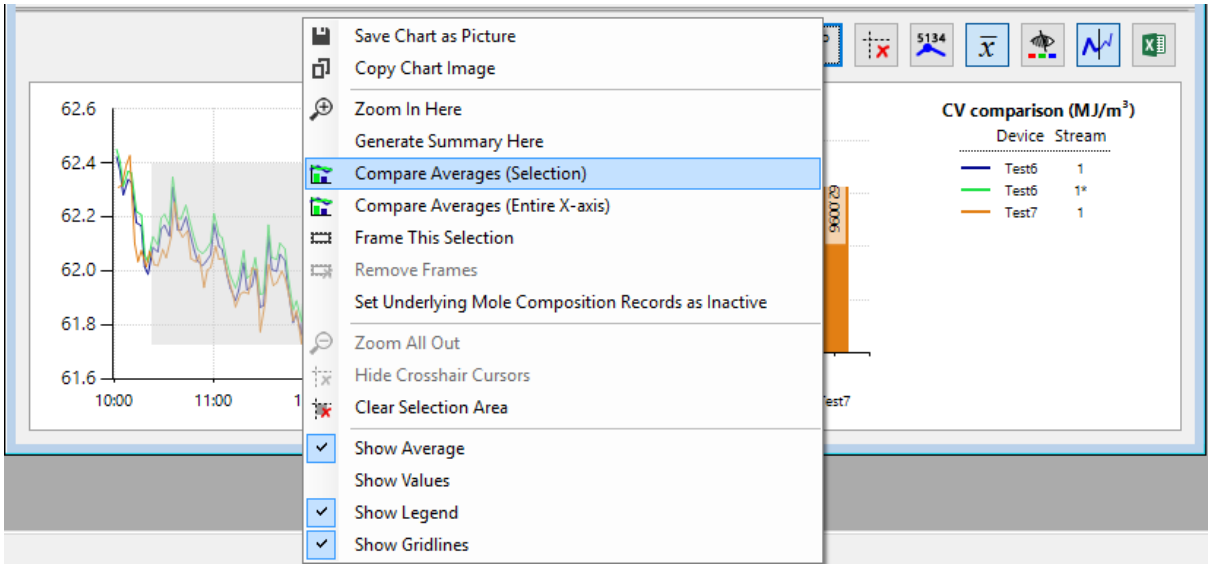
For a rough visual comparison, ISO 6976 Trend Comparison form provides an additional bar chart that shows the average value of every comparison entry. Click **Show average** button (the one having $\bar{x}$

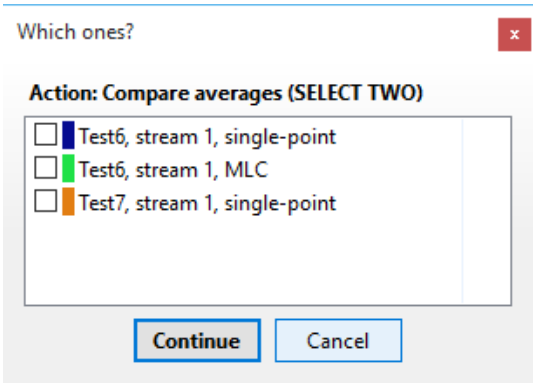
symbol) to reveal this chart. The average value of each bar is displayed on the label sitting at the top end of the bar.



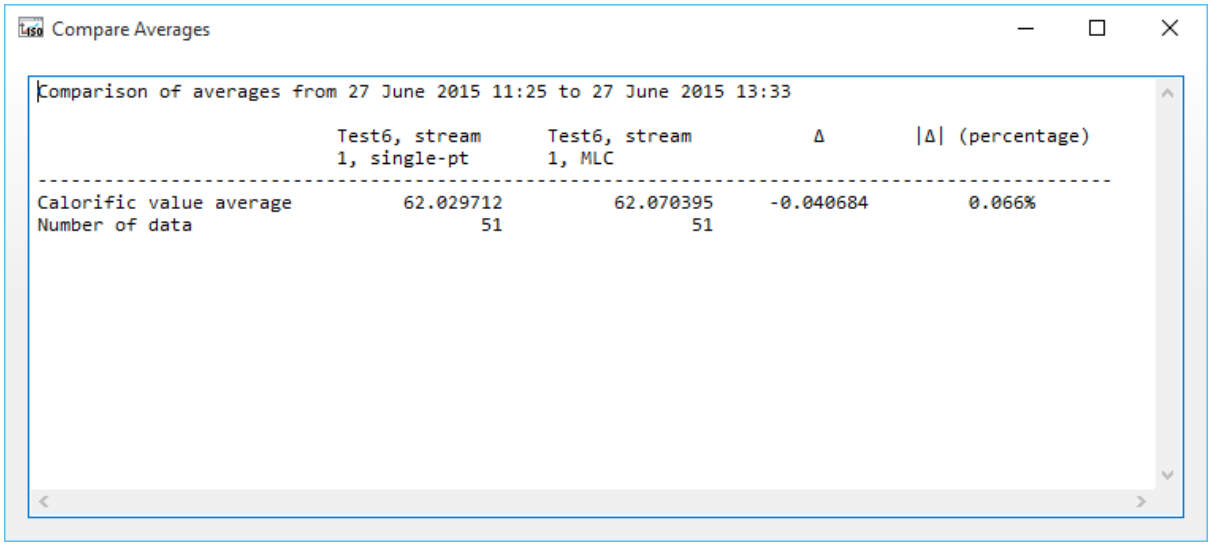
21.3.6.2 'Compare Averages' Menu

Sometimes users need a more detailed information of how two comparison entries differ to each other. To do this, switch the chart to selection mode. Afterwards, either make a selection rectangle and right click then choose **Compare Averages (Selection)**, or right click without a selection and select **Compare Averages (Entire X-axis)**. If your chart or selection rectangle contains more than two lines, you are prompted to select two among them.





Next, GCAS Desktop builds a comparison and displays them on a text viewer window similar to this one below.


Compare Averages
Comparison of averages from 27 June 2015 11:25 to 27 June 2015 13:33
Test6, stream 1, single-pt
Test6, stream 1, MLC
Δ
|Δ| (percentage)
Calorific value average 62.029712 62.070395 -0.040684 0.066%
Number of data 51 51

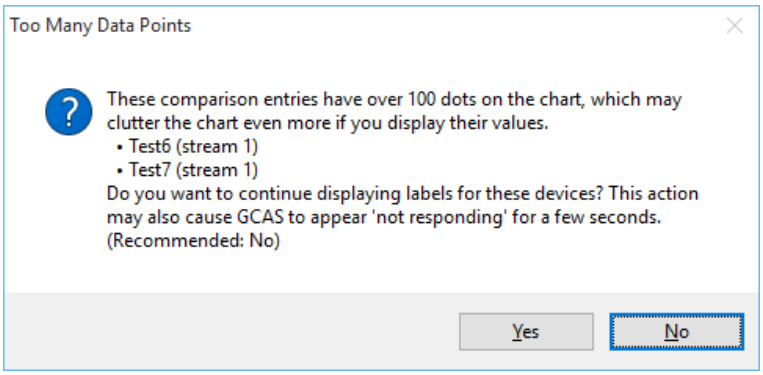
First row is the comparison. First column is the first comparison entry which was selected on the previous dialogue box, let's call it A. Next column is the second comparison entry, let's call it B. Then the delta is A minus B, and finally you get absolute difference in percentage relative to A.

Second row contains number of data (N) used to calculate the average. The reason is ISO 6976 Trend Comparison form can compare ISO 6976 trends between devices, and each GC device may not have the same number of data.

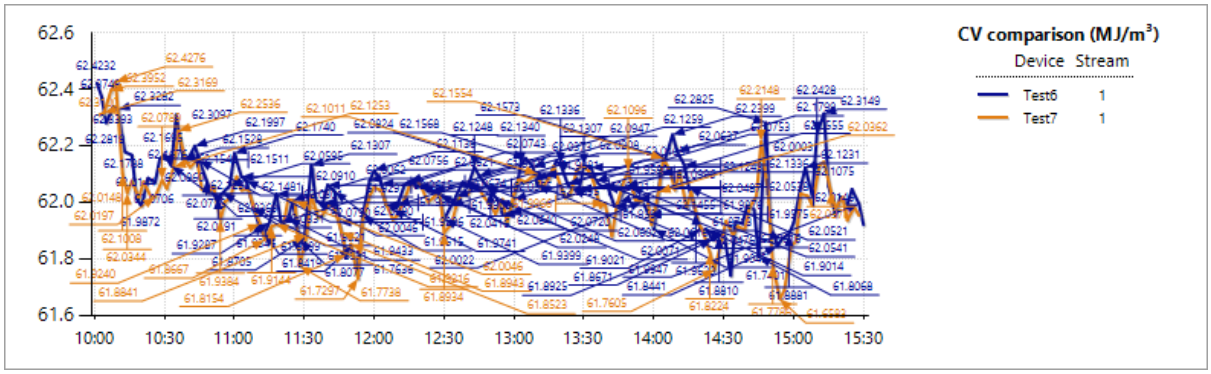
21.3.7 Other Visual Cues

By default, GCAS Desktop draws the chart using a thin line. The toggle button **Use thin lines** is pressed by default. If you prefer the usual thick lines, click this button to raise it from its pressed state.

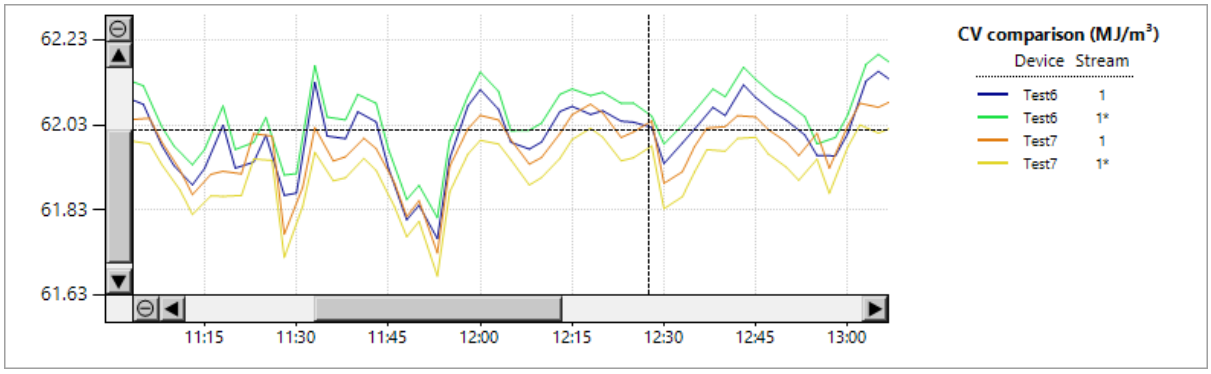
Click **Show values** or right click the chart and select **Show Values** to display the ISO 6976 values. GCAS Desktop presents a warning if one or more devices have over 100 dots on the chart. We do not recommend to display value labels on line charts with over 100 dots because it will clutter the chart area.


Too Many Data Points
These comparison entries have over 100 dots on the chart, which may clutter the chart even more if you display their values.
• Test6 (stream 1)
• Test7 (stream 1)
Do you want to continue displaying labels for these devices? This action may also cause GCAS to appear 'not responding' for a few seconds.
(Recommended: No)
Yes
No

This is how the chart would look like if the user clicked **Yes** anyway.

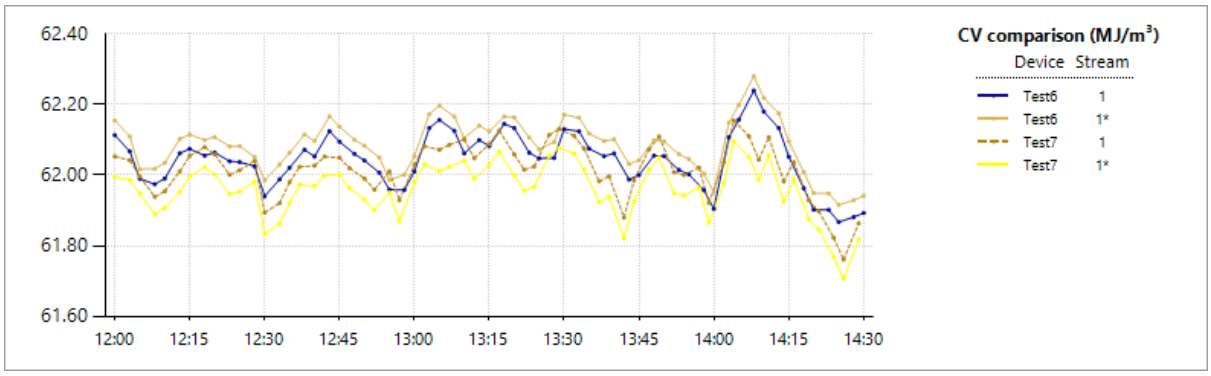


These dashed lines are called *cursors*. Cursors appear when you click on a chart or as a remnant of zoom operation. Cursor may act as a ruler line to compare Y-axis values of two data points. Click **Hide crosshair cursors** or right click the chart and select **Hide Crosshair Cursors** to hide these lines from view.



21.3.8 Colourblind Assistance

To aid users with colour blindness (protanopia and deuteranopia), GCAS Desktop provides an alternative colour scheme for the chart. Use the **Colourblind assist** button to switch colour scheme.



ISO 6976 trend comparison chart with colourblind assist turned on.
Colourblind assistance works better if you use thick lines because thick lines have subtle shadow to aid the user distinguishing the yellow line and white background.

22 ISO 10723

ISO 10723:2012 is a standard method used to adjust values in non-linear GC devices. Support for ISO 10723 first came in GCAS Desktop version 1.6.0.0. We gradually added more features and modules and finally full support of ISO 10723 was completed in version 1.7.3.0. With ISO 10723, GCAS Desktop makes a differentiation between *single-point* and *multilevel-calibrated* (MLC) response factor and mole composition.

All subchapters in this chapter assume you have GCAS feature *ISO 10723* included in your licence.

22.1 MLC Coefficients (Concept)

Multilevel calibration coefficients (abbreviated MLC coefficients) are the coefficients of the *analysis function* as described in ISO 10723 standard. Similar to uncertainty coefficents, although not about the same meaning, MLC coefficients consist of four coefficients. These four come from the equation

$$y = a + bx + cx^2 + dx^3$$

where *y* is multilevel-calibrated peak area, *x* is single-point peak area, and *a*, *b*, *c*, *d* are the MLC coefficents. Coefficient *a* and *b* are mandatory, and also *b* must not equal to zero. Coefficient *c* and *d* are not always present in the analysis function, depending on the GC.

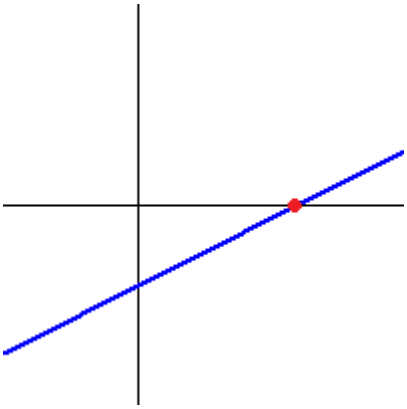
The term *coefficient set* refers to collection of MLC coefficients for all gases. Every gas has their own analysis function/equation, thus has their own coefficents. These coefficients are bundled together into one record of *MLC coefficient set* in GCAS database.

22.2 MLC Constraints (Concept)

Multilevel calibration constraints (abbreviated MLC constraints) are a set of rules to determine which root to use in polynomial MLC to single-point conversion. The opposite direction, single-point to MLC conversion, doesn't need constraints. MLC constraints consist of linear constraint, quadratic constraint, and cubic constraint. Recall the equation of analysis function:

$$y = a + bx + cx^2 + dx^3$$

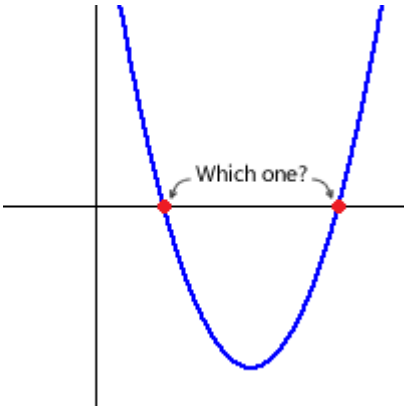
During MLC to single-point conversion, the task is "given this *y* value, find *x* that satisfies this equation". A polynomial function may have several roots (solutions) therefore MLC to single-point conversion require constraints to select the correct root. On the other hand, single-point to MLC conversion is much easier. "Find *y*, given this *x* value" means GCAS Desktop simply subtitues the *x* and evaluate the function to get *y*.



Linear constraint

If the coefficient *c* and *d* are zero, the equation becomes $y = a + bx$ which is linear. Linear functions are guaranteed to have one root, however it can be negative.

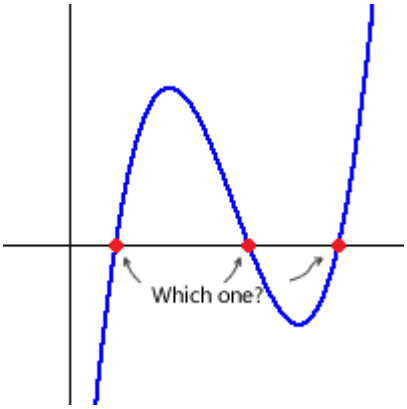
Linear constraint tells GCAS Desktop to disregard the negative root (then set *x* into zero), or to take absolute value in order to make the *x* positive. The default is to reject (disregard) negative root.



Quadratic constraint

If the coefficient *d* is zero, the equation becomes $y = a + bx + cx^2$ which is quadratic. Quadratic functions may have two real roots, one real root, or no real roots at all (solution is imaginary root).

GCAS Desktop always disregards imaginary root and sets *x* to zero, as well as any real roots which are negative. But in cases of one or two positive roots, quadratic constraint tells GCAS Desktop to use either the smallest positive or largest positive. The default is to use the smallest positive.



Cubic constraint

If all the coefficients are non-zero, the equation is cubic. Cubic functions may have one real root (+ 2 imaginaries), two real roots, or three real roots. Even though every possibility contains real roots, the roots may be negative. GCAS Desktop always rejects negative real roots. That leaves the positive ones, which are subject to the constraints described below. One exception: if all roots are negative, GCAS Desktop sets the *x* into zero.

GCAS Desktop has different cubic constraint depending what type of record is being converted. For response factor, GCAS Desktop offers four choices:

1. Use the smallest positive,
2. Use the largest positive,
3. Use the one which yields a single-point RF value inside a range, or
4. Use the one which yields a single-point RF value *inside or closest to* a range.

If you choose option 3 or 4, you have to set the range's lower and upper bound. The default is between 500,000 and 15,000,000 because typical single-point RF values fall between that range.

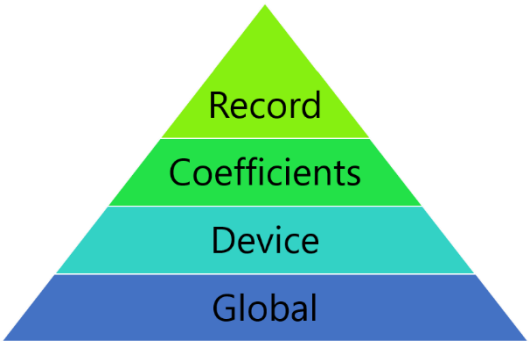
For mole composition, GCAS Desktop offers another four choices:

1. Use the smallest positive,
2. Use the middle one if there are 3 roots, or smallest one if there are 2 roots,
3. Use the middle one if there are 3 roots, or largest one if there are 2 roots, or
4. Use the largest positive.

In both cases, the default cubic constraint is option 1.

Most of the time, you don't have to worry about MLC constraints. As far as we tested, the default constraint has worked for vast, vast majority of RF and mole composition records. There is a tiny tiny chance the default constraints do not produce the expected result, which in this case you need to override the MLC constraints. Visit chapter 22.3 to read more about levels of MLC constraints override, or chapter 22.5 for how to actually override the MLC constraints.

22.3 MLC Constraints Override Level (Concept)



MLC constraints have a scope. From the most generic to the most specific, the order of scopes are *global*, *device*, *coefficient*, and *record*.

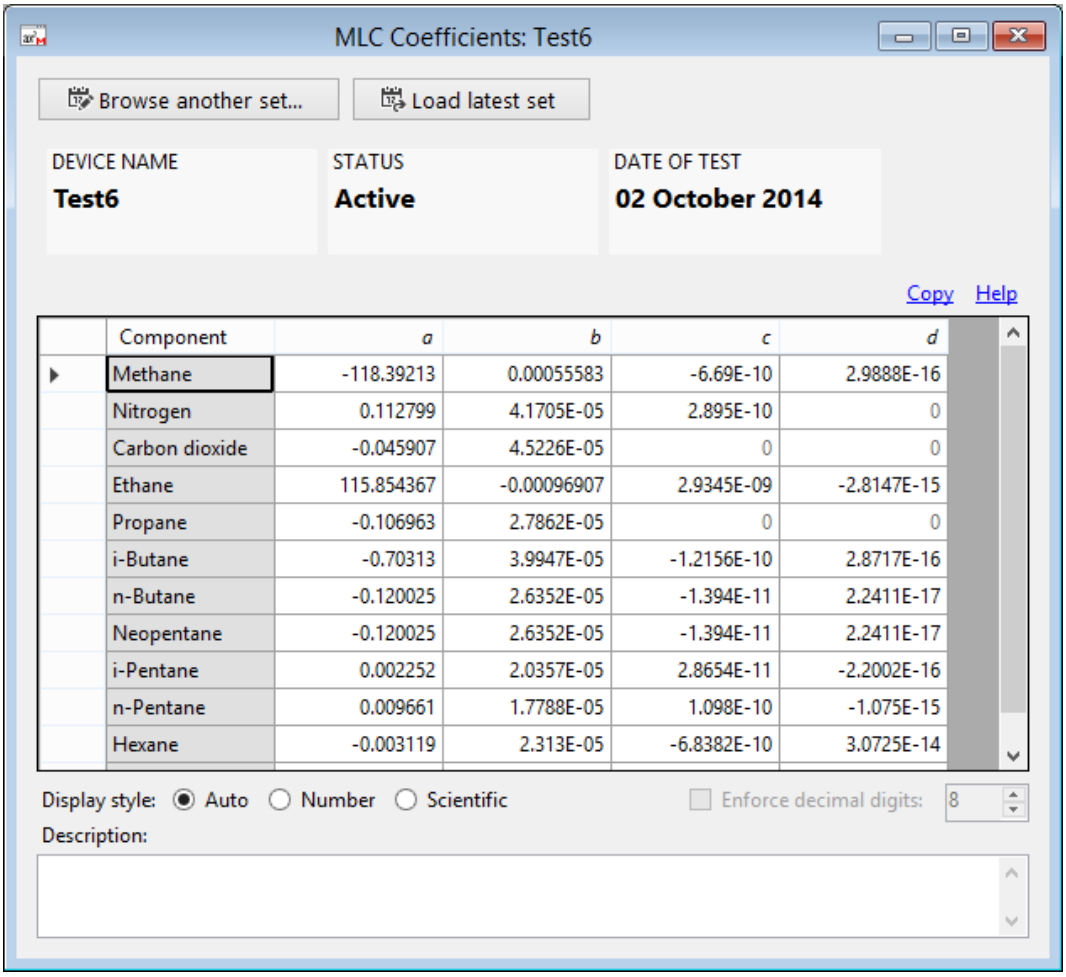
Global constraints are hardcoded inside your GCAS database. The factory values are reject negative root for linear functions, use smallest positive for quadratic functions, and use smallest positive for cubic functions—although you can change these global constraints if required. Second level of override is **device-level**. All ISO 10723 conversions on this device will use these MLC constraints instead of global constraints. Third level of override is **coefficient-level**. All records using a particular MLC coefficient set shall use these constraints instead of the device-level constraints. But records using another MLC coefficient set will use another coefficient-level constraints if that coefficient set has one, or fall back onto device-level if not. Fourth level is **record-level**. On this level, the MLC constraints apply to that record only. Other records may have either their own record-level constraints, or fall back onto coefficient-level.

While GCAS Desktop is converting from MLC records to single-point, GCAS Desktop loads MLC constraints from the most specific which is at record-level. If current record has no record-level

override, GCAS Desktop moves down one step and look for coefficient-level override. If the MLC coefficients used by this record has no overridden MLC constraints, GCAS Desktop moves down one step again and look for device-level override. If current GC device has no MLC constraints defined either, then GCAS Desktop falls back to the global MLC constraints.

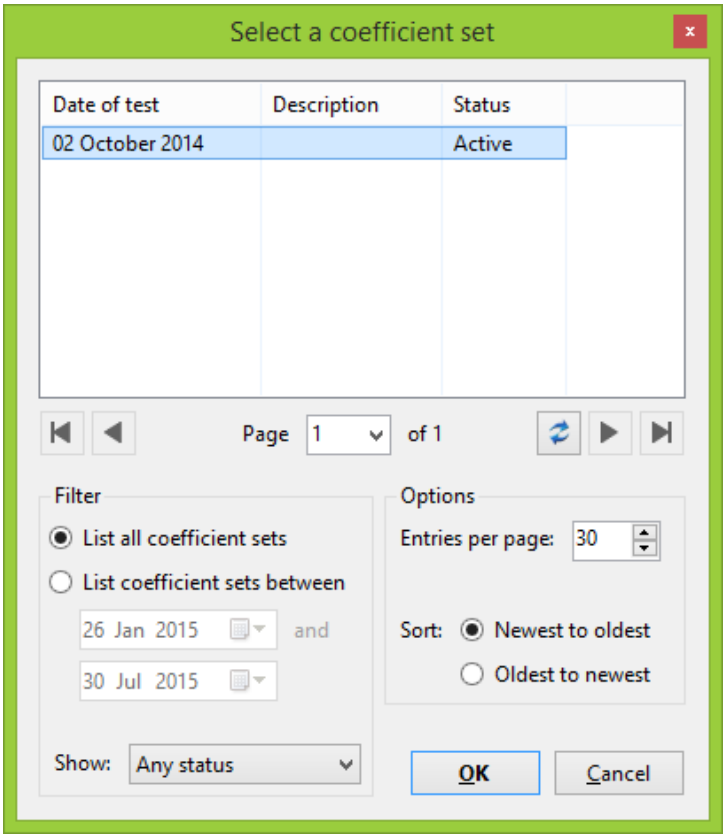
22.4 The *Multilevel Calibration Coefficients* Form

Multilevel Calibration Coefficients form, abbreviated as *MLC Coefficients* form, is a form to enter or edit MLC coefficients of a GC device. Select the desired device from your device panel or recent device panel, then go to View menu > **Multilevel Calibration Coefficients**.



22.4.1 View Previous Coefficient Sets

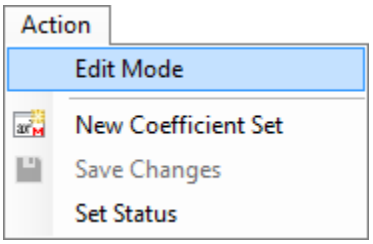
Click **Browse another set** at the top of the form. This button shows the *Select a coefficient set* dialogue. Select the desired coefficient set then click **OK** or double click on the list item.

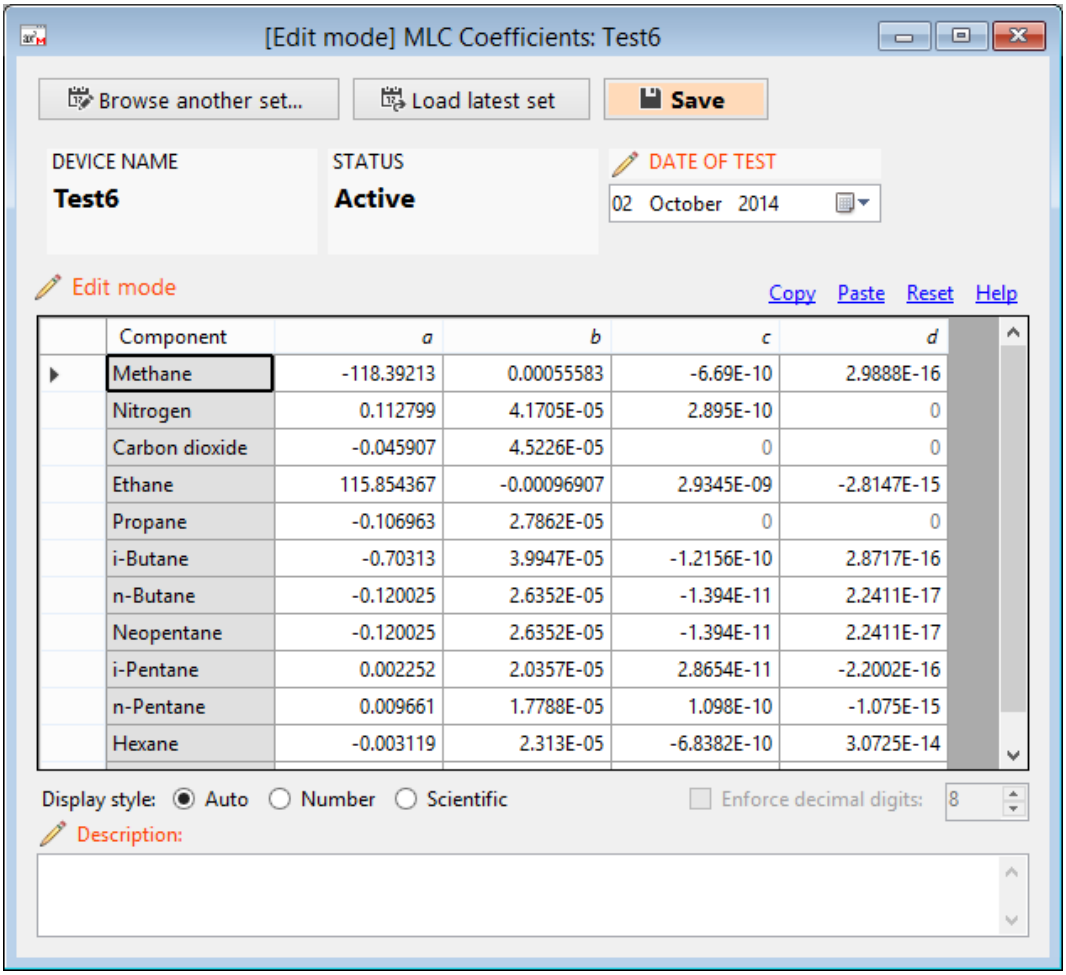


You can always return to the latest coefficient set through **Load latest set** button.

22.4.2 Edit Mode

In order to edit the coefficients or the description, you need to put MLC Coefficients form in *edit mode*. Open the Action menu and select **Edit Mode**. You know the form is on edit mode when you see pencil icon, some labels are coloured orange, and there is a **Save** button at the top region of the form.





During edit mode, you can edit the numbers in the grid. **Date of test** field at the top and **Description** text box at the bottom of the form also become editable.

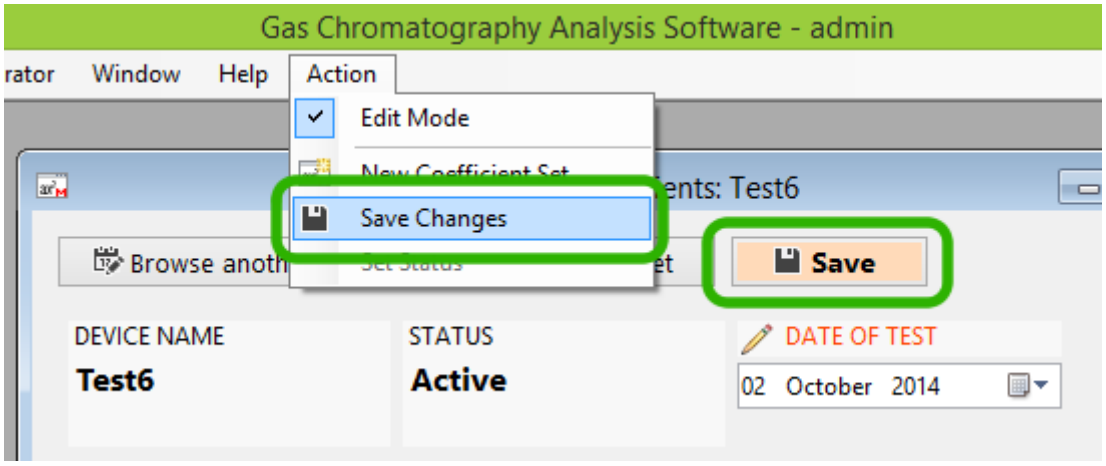
Note

Edit mode is mainly intended for editing the description or correcting minor mistakes. If there are too many coefficients to edit, we suggest you to create a new set and set this record to inactive instead.

MLC Coefficients form does not have comment feature. Put short comments in the description text box if you like.

You can paste the coefficient numbers from Microsoft Excel or other spreadsheet editing software, as long as there are 4 columns and equal number of rows. Click **Paste** link above the grid to paste the numbers. The **Reset** link resets all numbers in the grid back to zero.

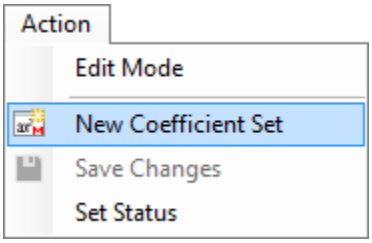
When you finished editing the numbers and the description, click **Save** button or go to Action menu > **Save Changes** to commit the change. The form exits its edit mode and becomes read-only again.



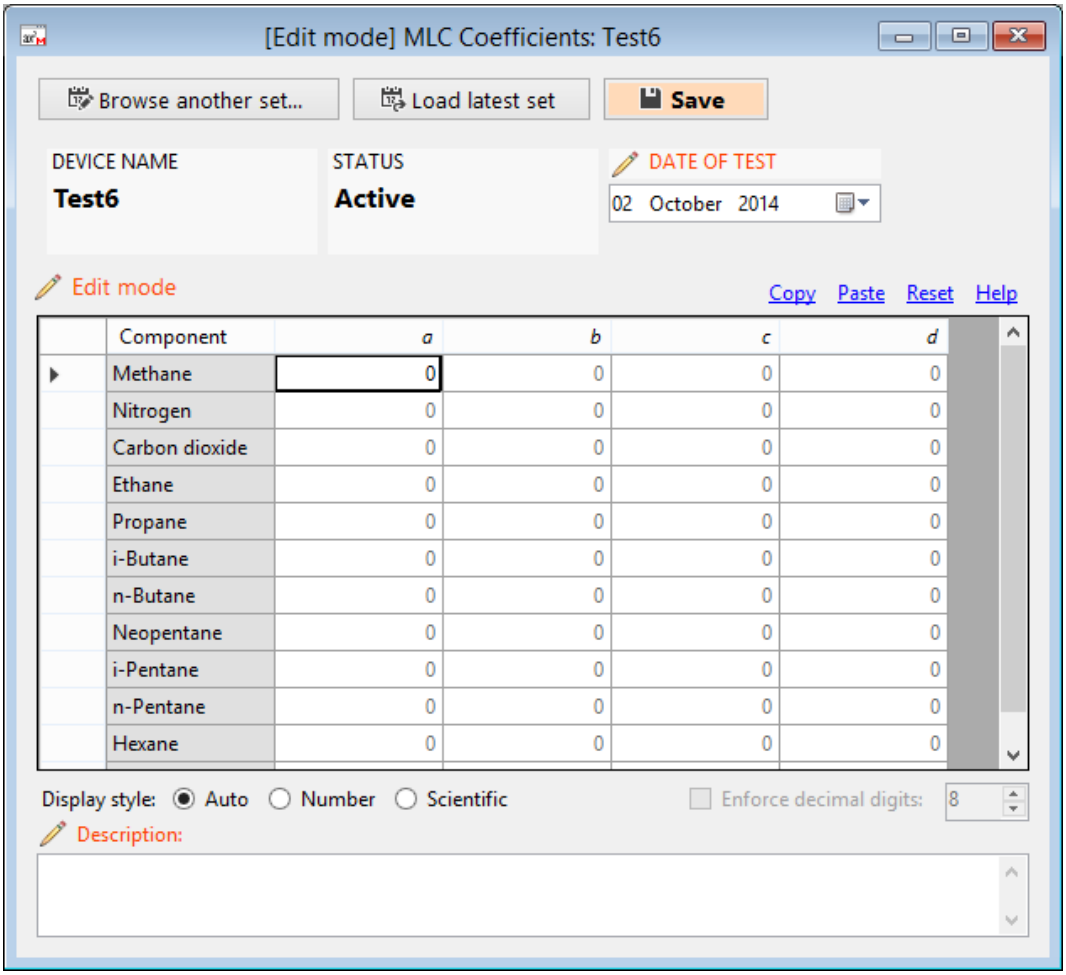
Otherwise to cancel editing and discard all of your changes, open Action menu and select **Edit Mode** again to remove its tick mark. This will exit edit mode and reload the coefficient set from the database.

22.4.3 Create New Coefficient Set

From an open MLC Coefficients form, open the Action menu and select **New Coefficient Set**. This menu creates a blank coefficient set (all zeroes) with the timestamp set to current computer time.



Begin entering the coefficient values one by one. Be alert for potential human error. Alternatively, you can paste the coefficients from Microsoft Excel or other spreadsheet editing software as long as there are 4 columns and equal number of rows. Click **Paste** to do so.



Don't forget to set the date of test. This is the date information of when the multilevel calibration was conducted, not the date of when the coefficients were entered.

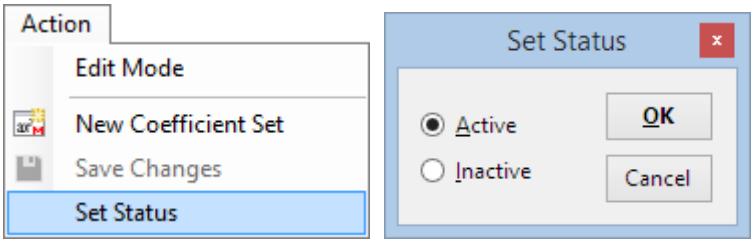
Write the description. It is a good practice to provide a description about this coefficient set.

When you are finished, click **Save** button or go to the Action menu > **Save Changes** to save these coefficients into database. Otherwise to cancel all of these, go to the Action menu > **Edit Mode** to remove its tick mark. The form will revert to the last record viewed.

22.4.4 Change Record Status

Like other types of record in GCAS database, MLC coefficient set has a status bit indicating whether the record is active or inactive. Inactive coefficient sets are not used for MLC conversions, thus GCAS Desktop will look further backward to find the previous active coefficient set.

To change status, open the Action menu and select **Set Status**. This menu brings the *Set Status* dialogue where you can flip the status bit from active to inactive or vice versa.



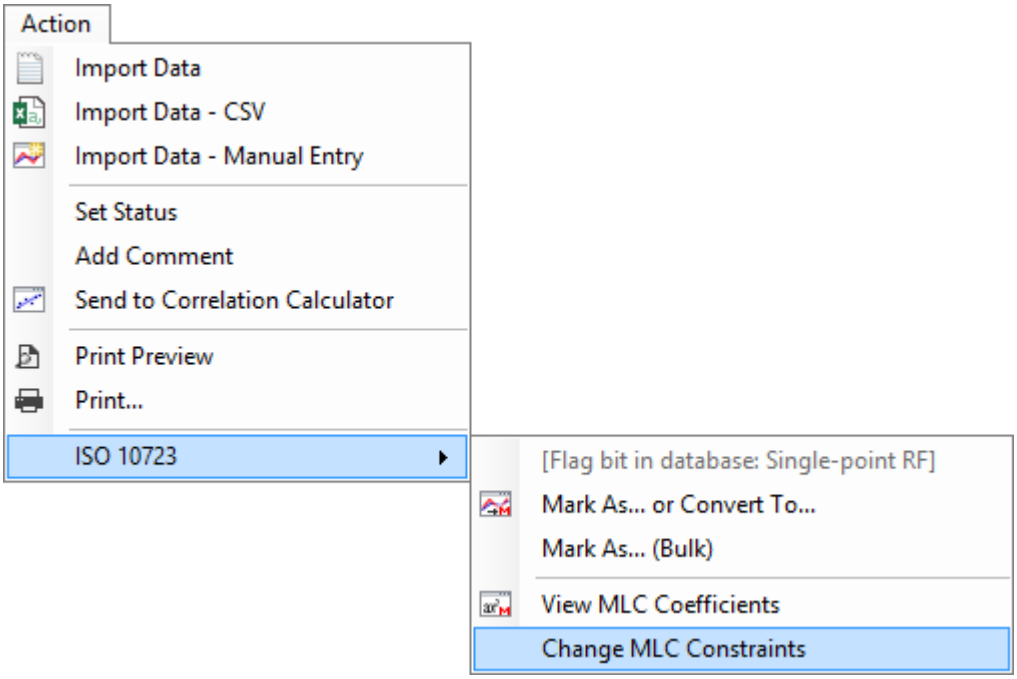
Click **OK** and GCAS Desktop will update the new status which then instructs the MLC Coefficients form to reload the set with the new status.

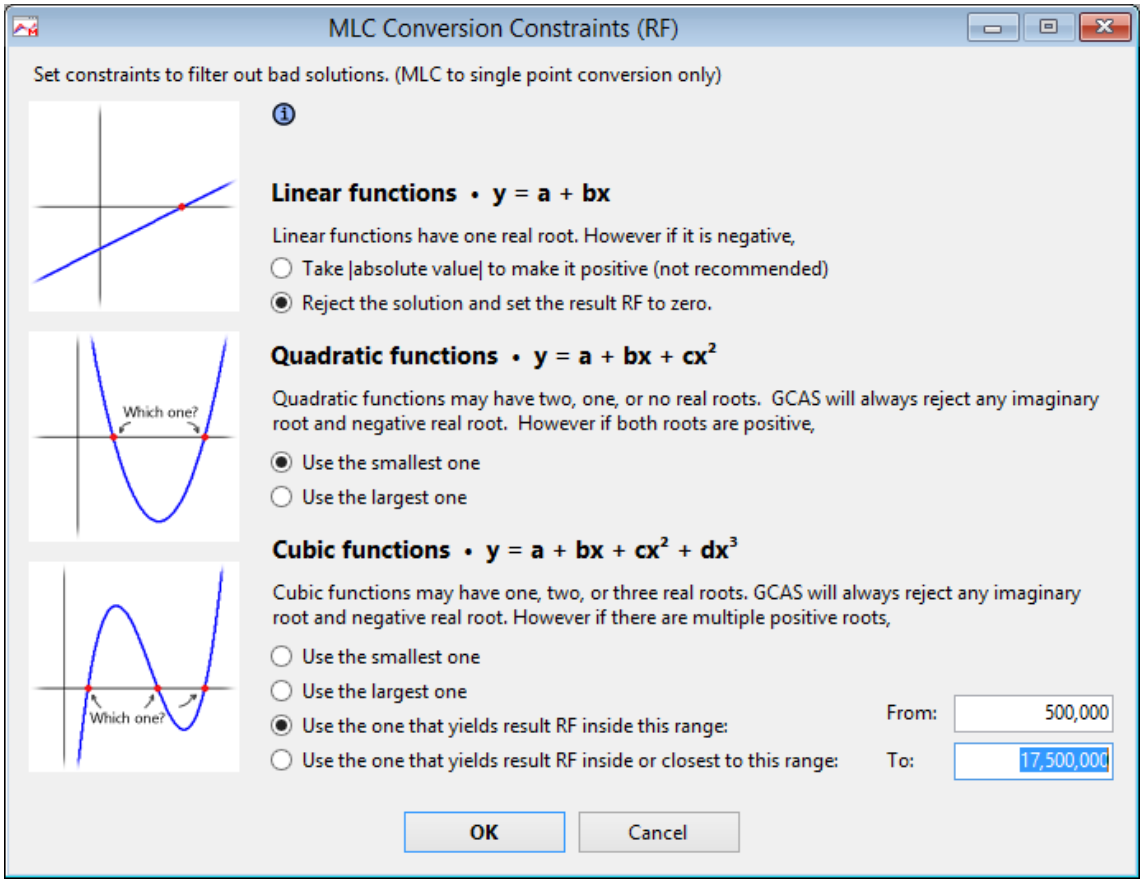
22.5 Overriding MLC Constraints

Chapter 22.2 already explained what MLC constraints are, and chapter 22.3 explained four levels of MLC constraints. This chapter explains how to actually override MLC constraints if the global or predefined constraints produce nonsensical RF or mole composition values.

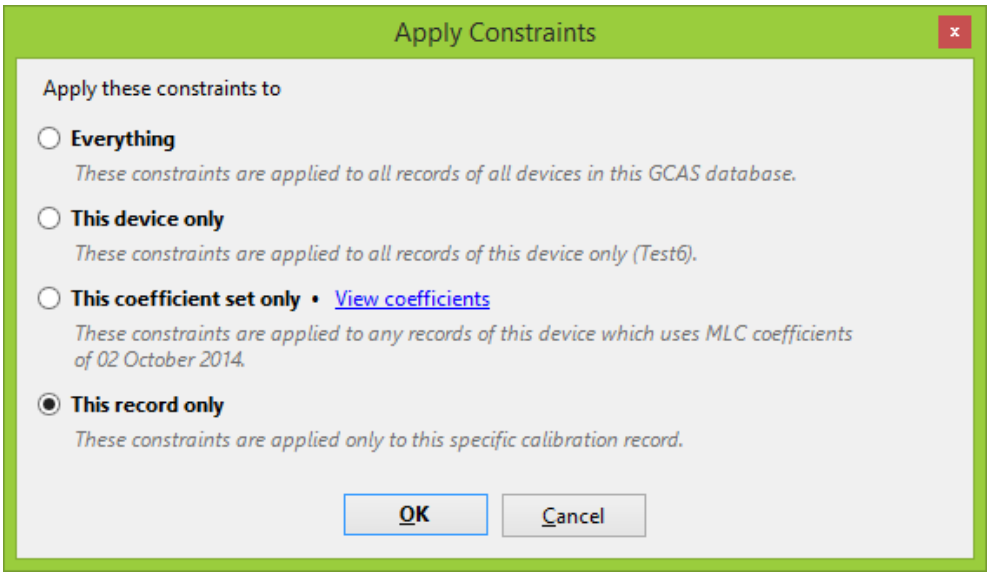
22.5.1 Overriding Constraints for Footprint/Calibration Data

From an open Footprint form or Calibration Data, open the Action menu, select **ISO 10723**, then select **Change MLC Constraints**. The *MLC Conversion Constraints (RF)* dialogue appears.




MLC Conversion Constraints (RF)
Set constraints to filter out bad solutions. (MLC to single point conversion only)
Linear functions • y = a + bx
Linear functions have one real root. However if it is negative,
Take |absolute value| to make it positive (not recommended)
Reject the solution and set the result RF to zero.
Quadratic functions • y = a + bx + cx²
Which one?
Quadratic functions may have two, one, or no real roots. GCAS will always reject any imaginary root and negative real root. However if both roots are positive,
Use the smallest one
Use the largest one
Cubic functions • y = a + bx + cx² + dx³
Which one?
Cubic functions may have one, two, or three real roots. GCAS will always reject any imaginary root and negative real root. However if there are multiple positive roots,
Use the smallest one
Use the largest one
Use the one that yields result RF inside this range:
From: 500,000
Use the one that yields result RF inside or closest to this range:
To: 17,500,000
OK
Cancel

Make changes as necessary. In this screenshot example, we are changing the cubic constraint as well as changing the target RF value range. When you click **OK**, GCAS Desktop presents you another dialogue asking which override level these new constraints are about to be applied.


Apply Constraints
Apply these constraints to
Everything
These constraints are applied to all records of all devices in this GCAS database.
This device only
These constraints are applied to all records of this device only (Test6).
This coefficient set only • View coefficients
These constraints are applied to any records of this device which uses MLC coefficients of 02 October 2014.
This record only
These constraints are applied only to this specific calibration record.
OK
Cancel

From top to bottom, each radio button corresponds to global constraints, device-level, coefficient-level, and finally record-level. Make a decision then click **OK**. The Footprint or Calibration Data form will reload the record and you may see the RF chart is now different from the previous one. If not, try another constraint values.

Note

Each option in this dialogue box requires its own action permission. The GCAS administrator has authority to assign which user roles can change global constraints, device-level, coefficient-level, or record-level. For example, an administrator may prohibit regular users to change global and device-level constraints, but permit them to change coefficient-level and record-level constraints. If your administrator didn't grant you permission for a specific override level, its radio button will be disabled. Ultimately if no permissions are given, you will not see *Change MLC Constraints* in the Action menu from the beginning.

Which override level should I apply to?

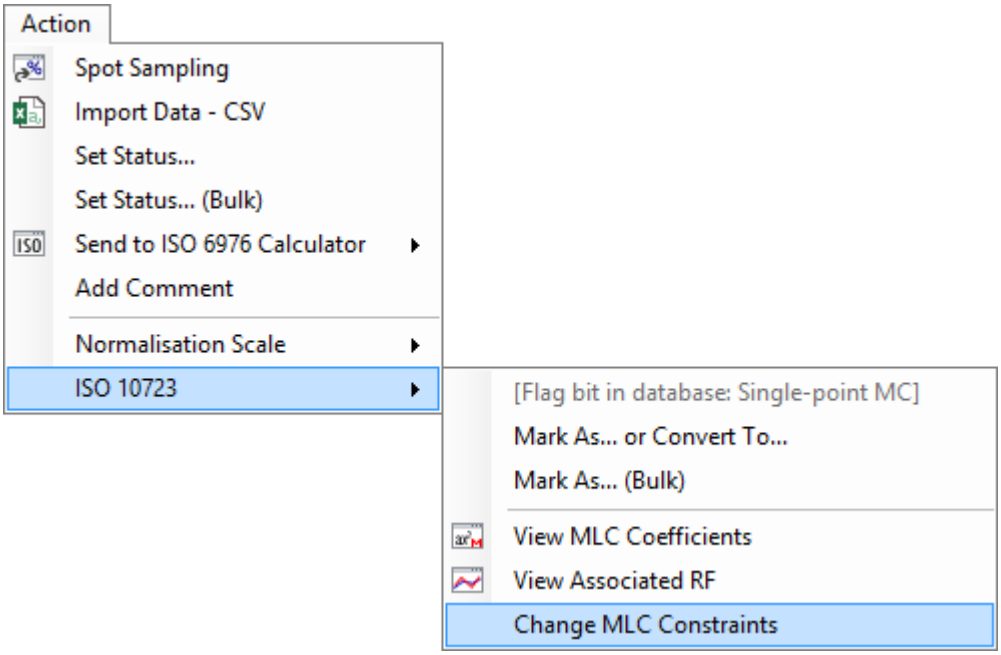
Be careful with the first option in *Apply Constraints* dialogue box. Yes, that option means you are changing the value of global constraints. All other devices in the same GCAS database will use the new constraint values you just specified.

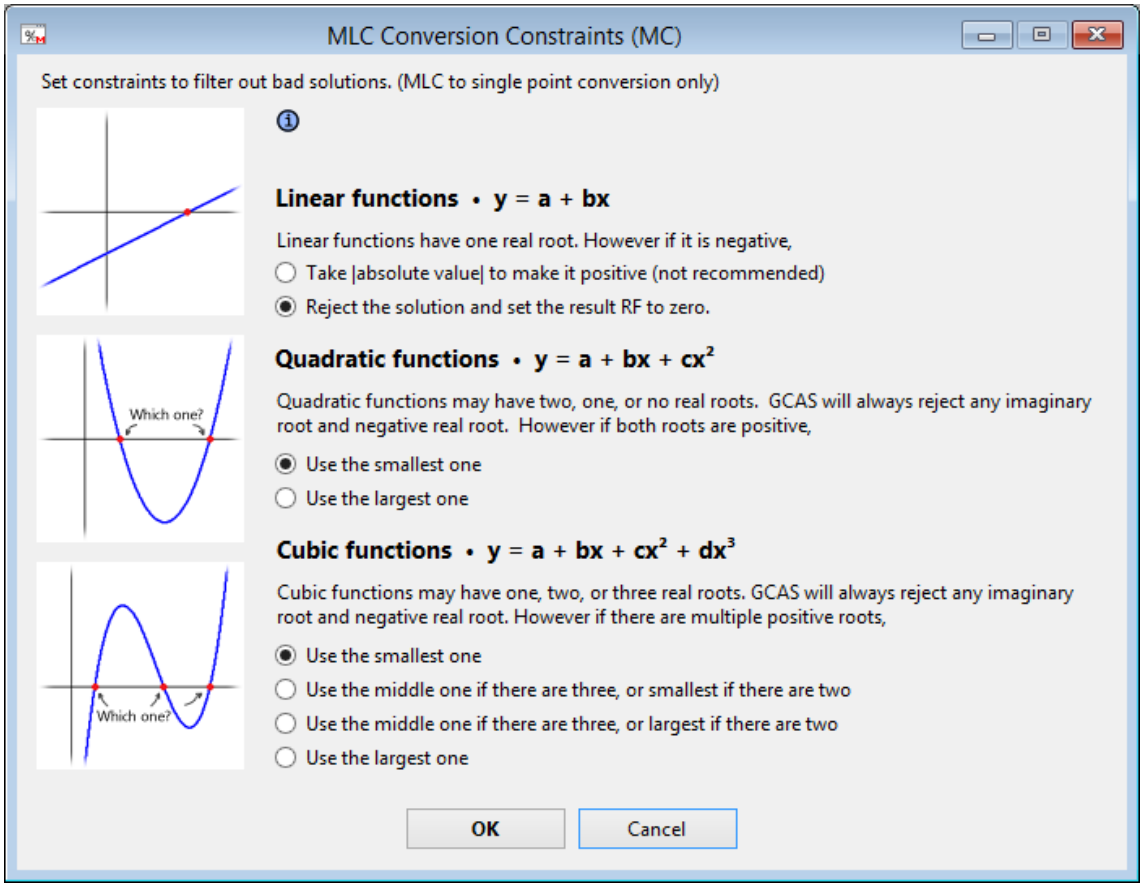
Condition	Recommended override level
You are unsure whether the new constraints would produce unwanted side-effects on other records.	Record-level
Some records are broken, while some others are not.	Coefficient-level if those broken records use the same MLC coefficients, otherwise apply record-level override to each of those one by one.
All records are broken, but records on other GC devices are not.	Device-level
All records are broken, regardless of what GC device they belong to. (A very ultra-rare case)	Global (Also check all MLC coefficient values for potential mistakes.)

22.5.2 Overriding Constraints for Mole Compositions

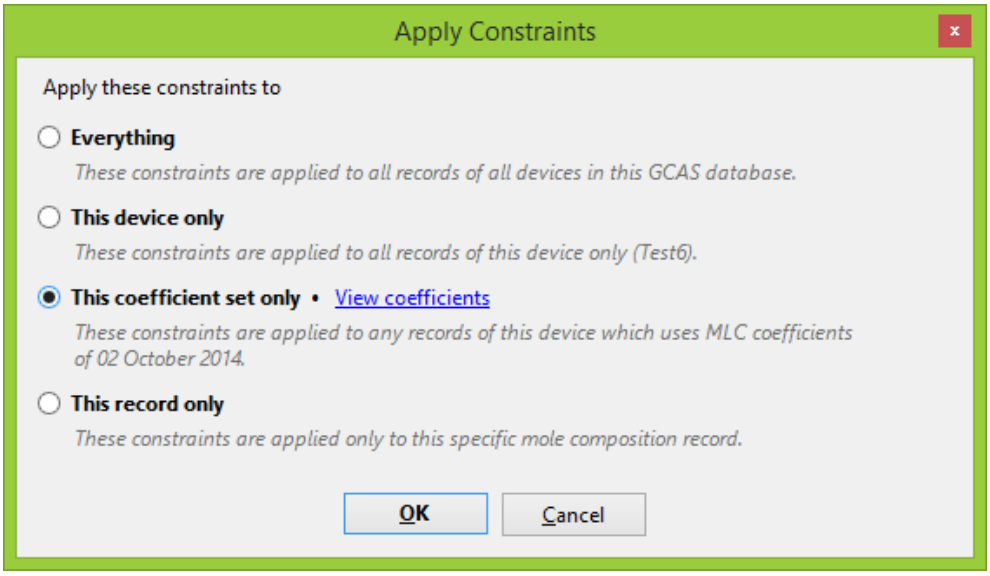
Many operations involving multilevel-calibrated mole compositions such as Data Analysis (MC value trending), uncertainty calculation, and ISO 6976 calculation, automatically load MLC constraints. Their MLC constraint overrides are set through Mole Composition form.

Open Mole Composition form, then browse to the desired record. Or if you plan to apply coefficient-level override, browse to any record which is using the MLC coefficient set in question. Then open Action menu, select **ISO 10723** and then **Change MLC Constraints**. The menu brings the *MLC Conversion Constraints (MC)* dialogue.




MLC Conversion Constraints (MC)
Set constraints to filter out bad solutions. (MLC to single point conversion only)
Linear functions • y = a + bx
Linear functions have one real root. However if it is negative,
Take |absolute value| to make it positive (not recommended)
Reject the solution and set the result RF to zero.
Quadratic functions • y = a + bx + cx²
Which one?
Quadratic functions may have two, one, or no real roots. GCAS will always reject any imaginary root and negative real root. However if both roots are positive,
Use the smallest one
Use the largest one
Cubic functions • y = a + bx + cx² + dx³
Which one?
Cubic functions may have one, two, or three real roots. GCAS will always reject any imaginary root and negative real root. However if there are multiple positive roots,
Use the smallest one
Use the middle one if there are three, or smallest if there are two
Use the middle one if there are three, or largest if there are two
Use the largest one
OK
Cancel

Change the constraints as necessary by paying attention to which gas that causes silly values followed by which degree of polynom the MLC coefficients of that gas is. Click **OK** and GCAS Desktop presents the familiar *Apply Constraints* dialogue box. Select an override level and hit **OK** again to commit.


Apply Constraints
Apply these constraints to
Everything
These constraints are applied to all records of all devices in this GCAS database.
This device only
These constraints are applied to all records of this device only (Test6).
This coefficient set only • View coefficients
These constraints are applied to any records of this device which uses MLC coefficients of 02 October 2014.
This record only
These constraints are applied only to this specific mole composition record.
OK
Cancel

Note

Each option in this dialogue box requires its own action permission. The GCAS administrator has authority to assign which user roles can change global constraints, device-level, coefficient-level, or record-level. For example, an administrator may prohibit regular users to change global and device-level constraints, but permit them to change coefficient-level and record-level constraints. If your administrator didn't grant you permission for a specific override level, its radio button will be disabled. Ultimately if no permissions are given, you will not see *Change MLC Constraints* in the Action menu from the beginning.

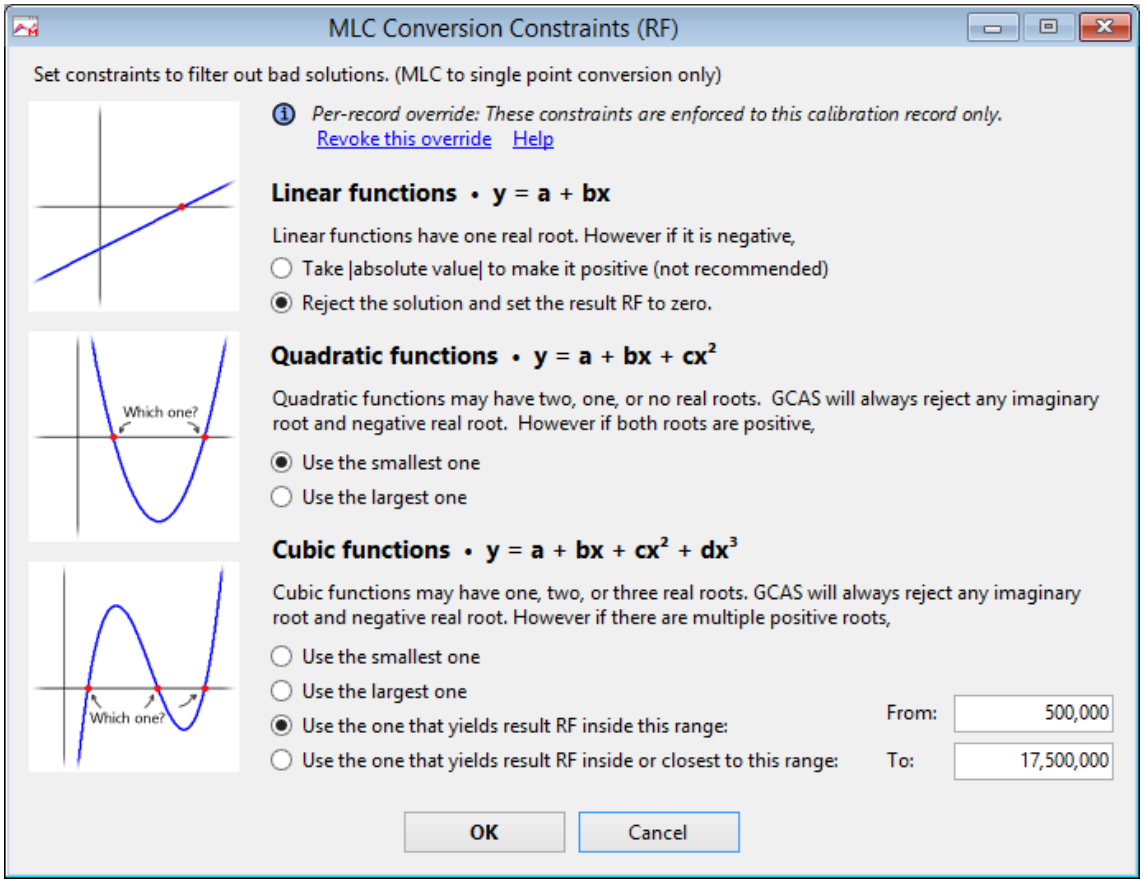
Which override level should I apply to?

Be careful with the first option in *Apply Constraints* dialogue box. Yes, that option means you are changing the value of global constraints. All other devices in the same GCAS database will use the new constraint values you just specified.

Condition	Recommended override level
You are unsure whether the new constraints would produce unwanted side-effects on other records.	Record-level
Some records are broken, while some others are not.	Coefficient-level if those broken records use the same MLC coefficients, otherwise apply record-level override to each of those one by one.
All records are broken, but records on other GC devices are not.	Device-level
All records are broken, regardless of what GC device they belong to. (A very ultra-rare case)	Global (Also check all MLC coefficient values for potential mistakes.)

22.5.3 Revoking (Cancelling) an Override

Open *MLC Conversion Constraints* dialogue again through **Change MLC Constraints** submenu in **ISO 10723** in the Action menu. Next to the blue info badge you shall see what override level the record is using. If no text is displayed, then the record is still on global MLC constraints.


MLC Conversion Constraints (RF)
Set constraints to filter out bad solutions. (MLC to single point conversion only)
Per-record override: These constraints are enforced to this calibration record only.
Revoke this override
Help
Linear functions • y = a + bx
Linear functions have one real root. However if it is negative,
Take |absolute value| to make it positive (not recommended)
Reject the solution and set the result RF to zero.
Quadratic functions • y = a + bx + cx²
Which one?
Quadratic functions may have two, one, or no real roots. GCAS will always reject any imaginary root and negative real root. However if both roots are positive,
Use the smallest one
Use the largest one
Cubic functions • y = a + bx + cx² + dx³
Which one?
Cubic functions may have one, two, or three real roots. GCAS will always reject any imaginary root and negative real root. However if there are multiple positive roots,
Use the smallest one
Use the largest one
Use the one that yields result RF inside this range:
From:
500,000
Use the one that yields result RF inside or closest to this range:
To:
17,500,000
OK
Cancel

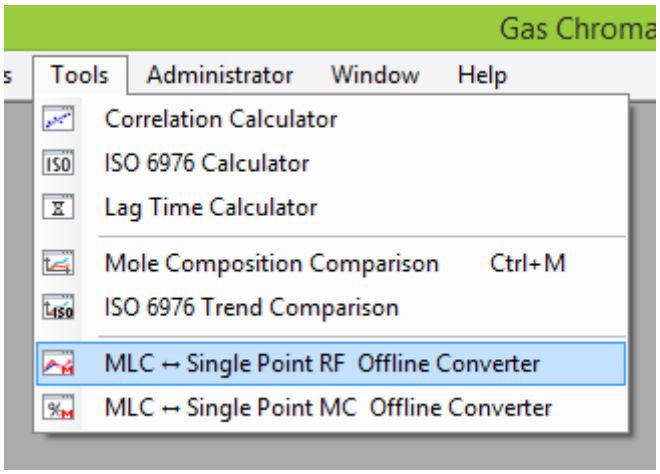
As an example, the screenshot above tells the calibration record is using record-level override. Now click **Revoke this override** to revoke it. Confirm the message box and then the dialogue will reload the MLC constraints from one level lower. Eventually it falls back to the global MLC constraints if there are no more overridden MLC constraints found. You know it's already on global MLC constraints when there is no text next to the blue icon badge.

Finally click **Cancel** (yes, Cancel button) to dismiss the dialogue. Clicking OK instead of Cancel button will show another *Apply Constraints* dialogue which you don't want anymore.

22.6 Offline Converter Tools

Offline converters are intended for one-time conversion of bulk records such as those in CSV files. The term 'offline' means it is not associated to any GC devices in GCAS database, which implies you can test any arbitrary MLC coefficents, calibration certificates, RF values, and custom constraints as conversion prerequisites without affecting any records in GCAS database.

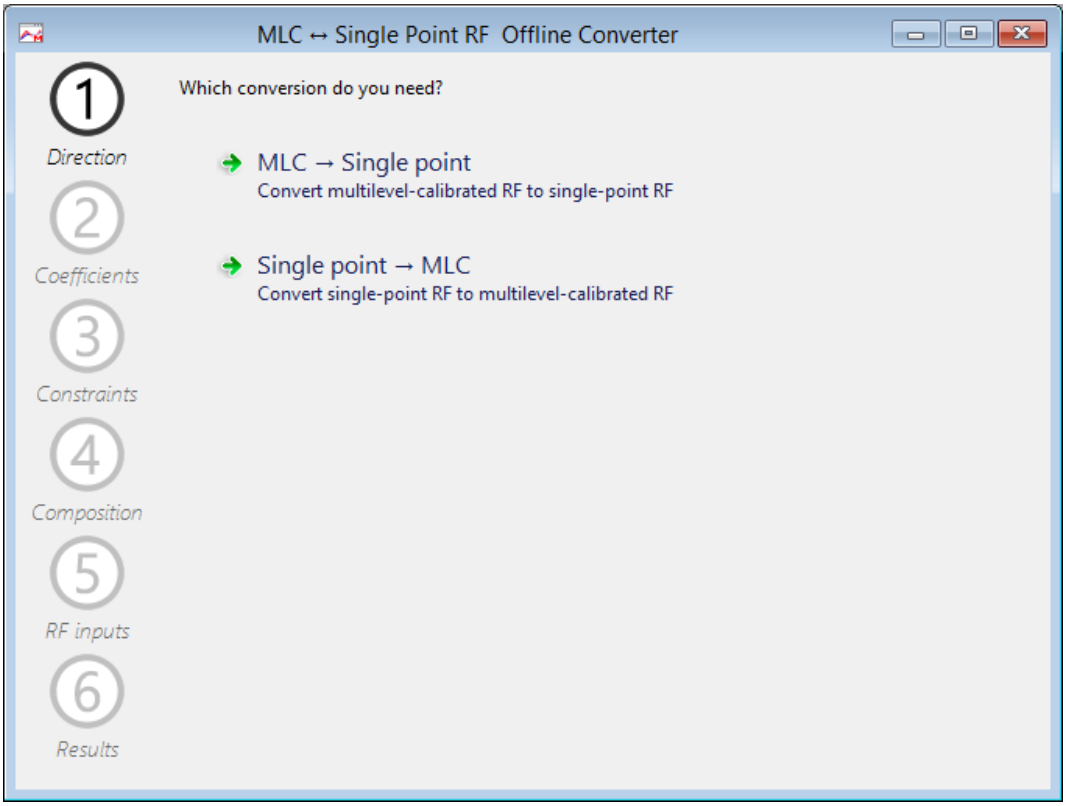
GCAS Desktop ships two converter tools. They can be found inside the Tools menu. Select **MLC ↔ Single-Point RF Offline Converter** to convert response factor values of footprint/calibration data, or **MLC ↔ Single-Point MC Offline Converter** to convert mole composition values.



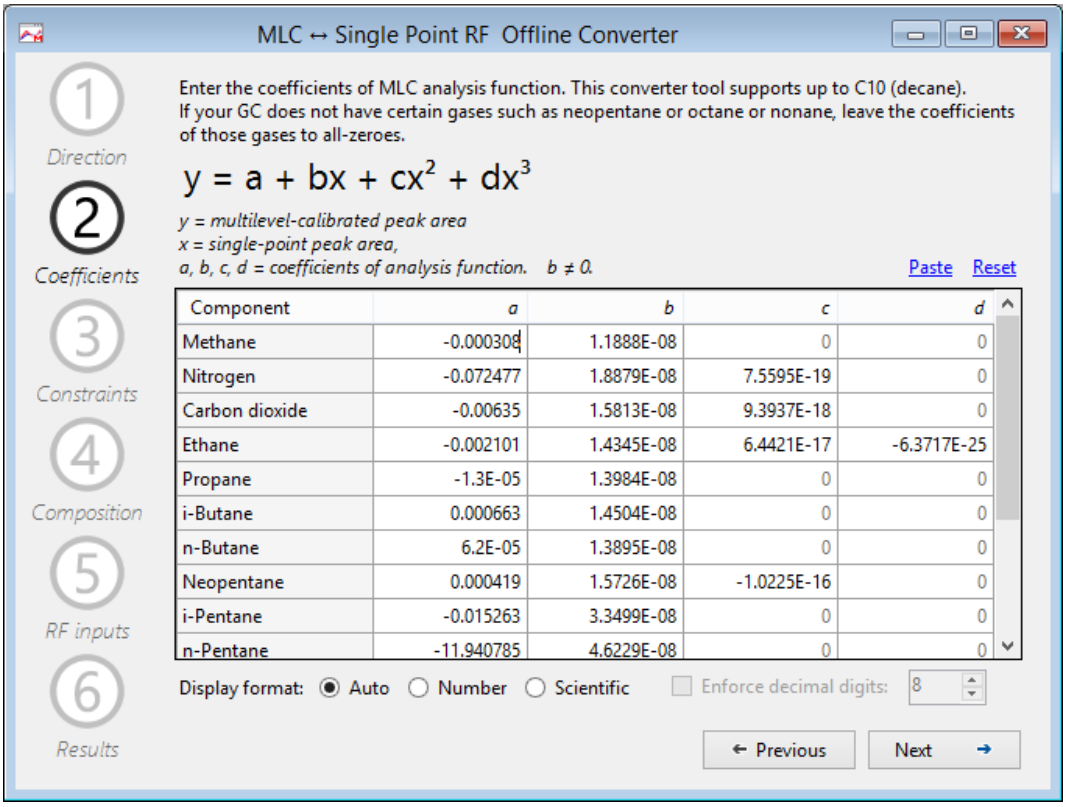
Converter tools have a wizard-like appearance. To get help about specific converter tool, read the following two chapters.

22.6.1 MLC ↔ Single-Point RF Offline Converter

This is an ISO 10723 converter tool for response factors. First, select a conversion direction whether from MLC to single-point or single-point to MLC.

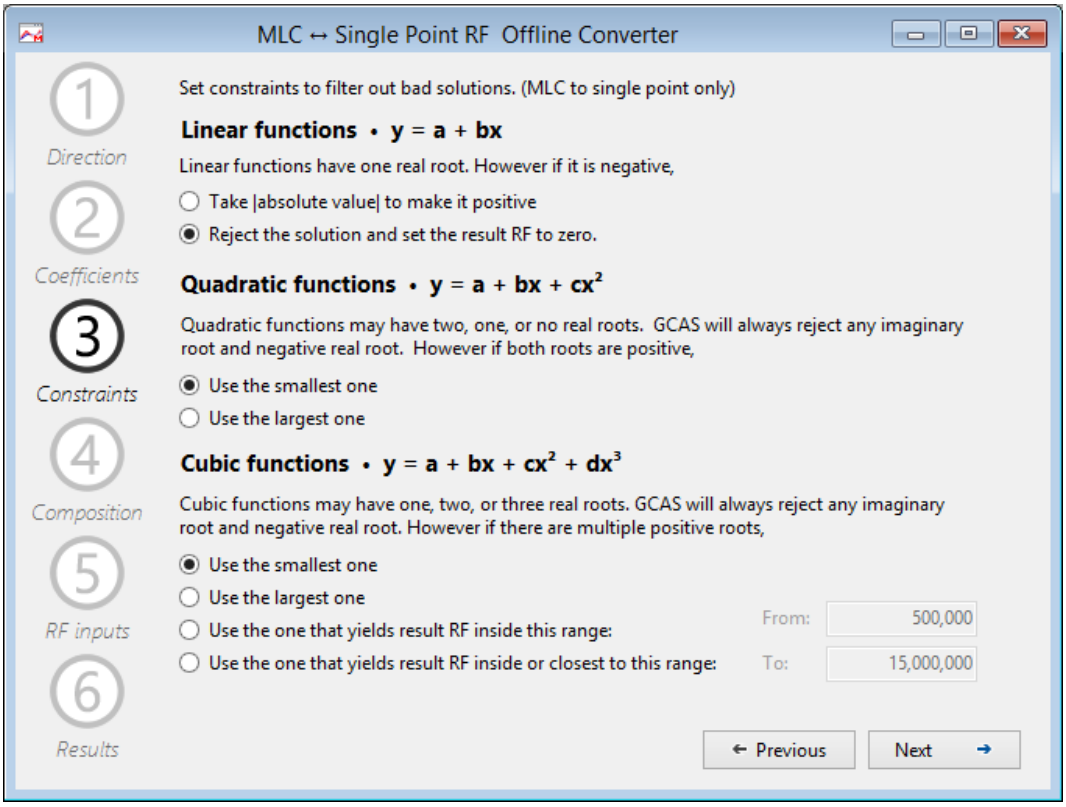


Next, enter the MLC coefficients. This page has similar layout to MLC Coefficients form. You can paste from Microsoft Excel or other spreadsheet processing software as long as the data has 4 columns and 15 rows (for 15 gases); click **Paste** to do so. If the footprints/calibration data to convert don't have gases such as octane, nonane, decane, or neopentane, leave the coefficients of those gases to all-zeroes.

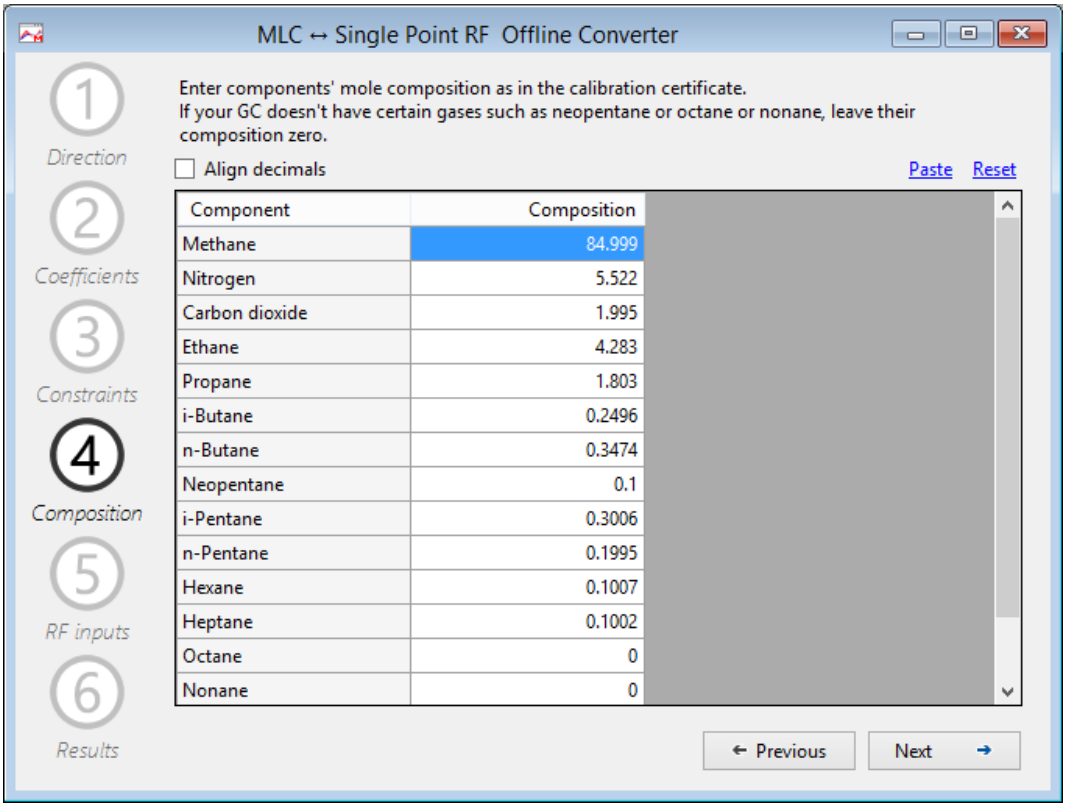

MLC ↔ Single Point RF Offline Converter
1 Direction
2 Coefficients
3 Constraints
4 Composition
5 RF inputs
6 Results
Enter the coefficients of MLC analysis function. This converter tool supports up to C10 (decane).
If your GC does not have certain gases such as neopentane or octane or nonane, leave the coefficients of those gases to all-zeroes.
y = a + bx + cx² + dx³
y = multilevel-calibrated peak area
x = single-point peak area,
a, b, c, d = coefficients of analysis function. b ≠ 0.
Paste
Reset
Component a b c d
Methane -0.000308 1.1888E-08 0 0
Nitrogen -0.072477 1.8879E-08 7.5595E-19 0
Carbon dioxide -0.00635 1.5813E-08 9.3937E-18 0
Ethane -0.002101 1.4345E-08 6.4421E-17 -6.3717E-25
Propane -1.3E-05 1.3984E-08 0 0
i-Butane 0.000663 1.4504E-08 0 0
n-Butane 6.2E-05 1.3895E-08 0 0
Neopentane 0.000419 1.5726E-08 -1.0225E-16 0
i-Pentane -0.015263 3.3499E-08 0 0
n-Pentane -11.940785 4.6229E-08 0 0
Display format: Auto Number Scientific
Enforce decimal digits: 8
← Previous
Next →

Click **Next**. Depending on conversion direction, the third page may be skipped. For MLC to single-point conversion, you are prompted to choose MLC constraints. Single-point to MLC conversion doesn't require constraints therefore this page is skipped.

Most of the time you don't have to worry about MLC constraints and you can click **Next** straight away. However in case of the conversion results having weird values, go back to this page and change the constraints to test whether the new constraints have corrected the conversion results.

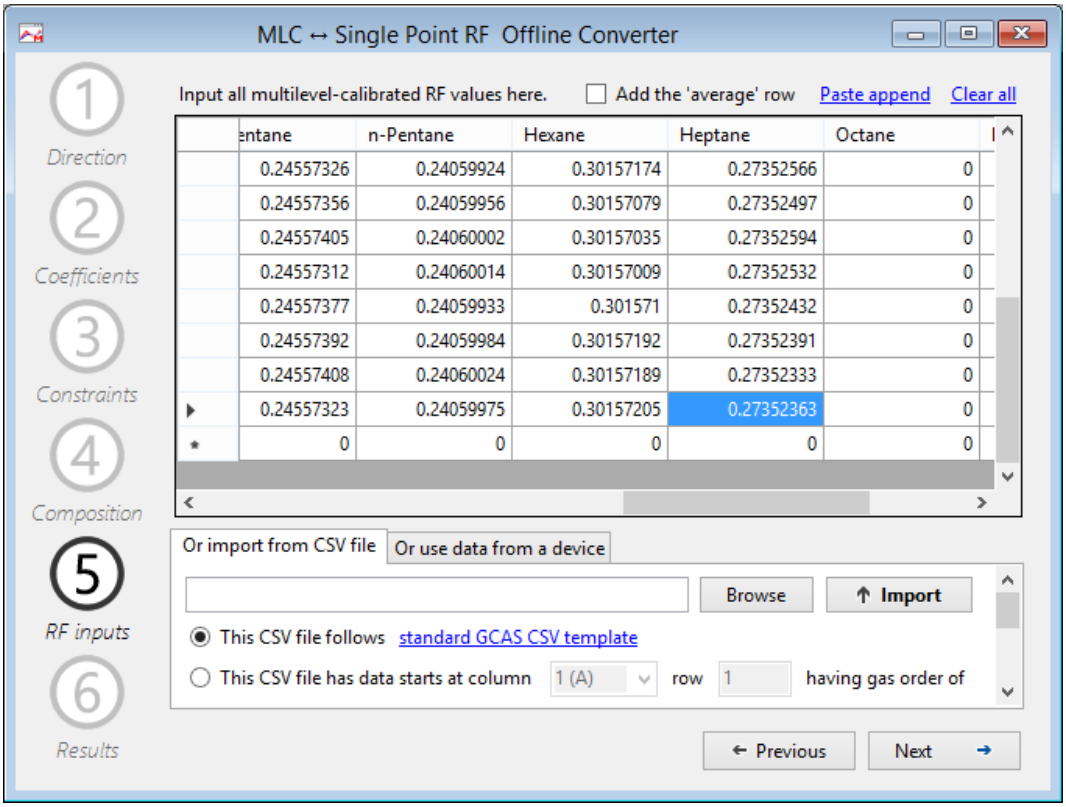

MLC ↔ Single Point RF Offline Converter
1 Direction
2 Coefficients
3 Constraints
4 Composition
5 RF inputs
6 Results
Set constraints to filter out bad solutions. (MLC to single point only)
Linear functions • y = a + bx
Linear functions have one real root. However if it is negative,
Take |absolute value| to make it positive
Reject the solution and set the result RF to zero.
Quadratic functions • y = a + bx + cx²
Quadratic functions may have two, one, or no real roots. GCAS will always reject any imaginary root and negative real root. However if both roots are positive,
Use the smallest one
Use the largest one
Cubic functions • y = a + bx + cx² + dx³
Cubic functions may have one, two, or three real roots. GCAS will always reject any imaginary root and negative real root. However if there are multiple positive roots,
Use the smallest one
Use the largest one
Use the one that yields result RF inside this range:
From: 500,000
Use the one that yields result RF inside or closest to this range:
To: 15,000,000
← Previous
Next →

Afterwards, enter the mole composition part of the calibration gas certificate. You can paste from Microsoft Excel or other spreadsheet software, click **Paste** to do so. If the footprints/calibration data to convert do not have gases such as neopentane, octane, nonane, or decane, leave their values to zero.



Next page is where you put the response factor values to convert. In this example, we are converting MLC RF into single-point RF. There are several ways to input RF values:

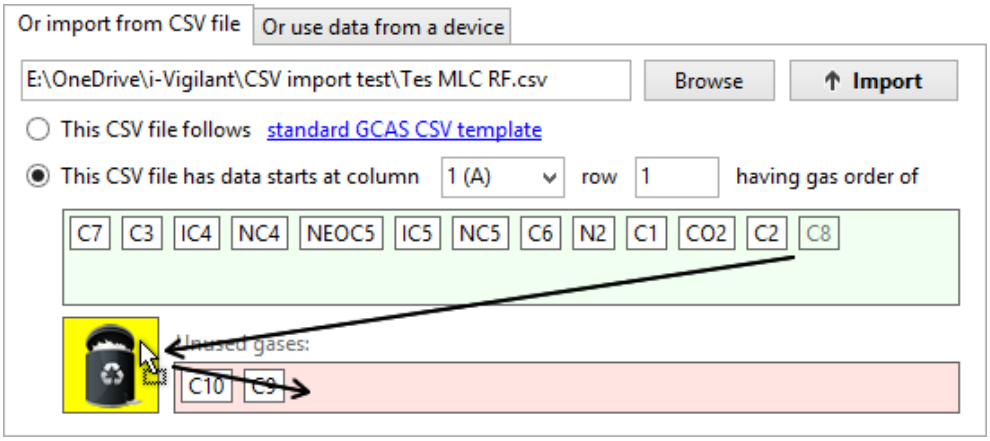
1. Orthodox method – typing them manually, row by row.
2. Copy and paste from Microsoft Excel or other spreadsheet processing software. Make sure the column ordering is correct as you may end up with wrong RF values in wrong gas. Click **Paste append** to paste from clipboard into new rows. Existing rows are not affected.
3. Import from CSV – please specify whether the CSV file follows standard GCAS CSV template or a custom template. More about this later.
4. Import from GC device in database – select a GC device and date range, then RF offline converter will load all active footprints and calibration data of that device between that date range.



Above the grid there is a check box called **Add the 'average' row**. This check box inserts a special row at the very top, which contains the averaged value of all rows below it. Average row will be converted to MLC or single-point too, depending on selected direction during the first page. If you delete some rows or edit some rows or append new rows into this grid, the average values are updated automatically.

For CSV import, select whether the CSV file follows the standard template or you are using your own CSV file. Select the second radio button for CSV files with additional columns before the first gas, or with additional header rows before the first row, or with different gas ordering, or combination of these. Define at which column and which row the actual data start. If necessary, change the gas order definition to match your CSV file.

Reorder those gases using drag-and-drop operation inside the green area. Had there any gases not present in your CSV such as octane/C8, nonane/C9, or decane/C10, drag them to the trash bin icon and they will move to the *unused gases* (pink) area. Drag gases out of the pink area back into the green area to reuse them if necessary.

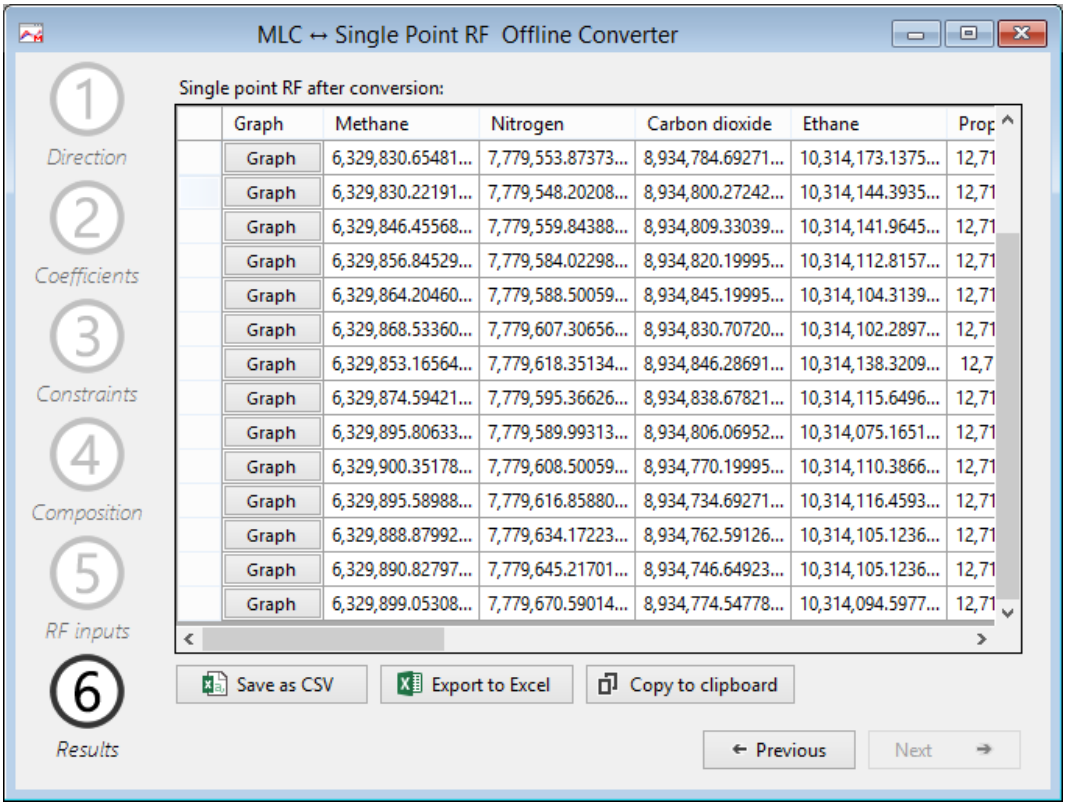

Or import from CSV file
Or use data from a device
E:\OneDrive\i-Vigilant\CSV import test\Tes MLC RF.csv
Browse
Import
This CSV file follows standard GCAS CSV template
This CSV file has data starts at column 1 (A) row 1 having gas order of
C7 C3 IC4 NC4 NEOC5 IC5 NC5 C6 N2 C1 CO2 C2 C8
Unused gases:
C10 C9

Finally, click **Import**. GCAS Desktop reads your CSV file and appends data into new rows. Existing rows are not affected. Also the converter form reveals an additional column named **Notes** and writes the CSV file name followed by row number.

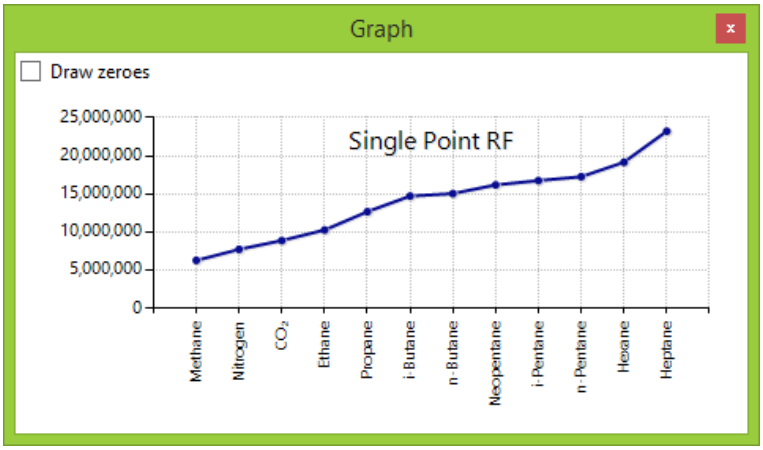
If you import data from a device (second tab of the tab pages below the grid), the converter form reveals the **Notes** column and writes device tag name followed by record timestamps. These notes help you differentiate which rows belong to which device in case you are converting bulk records from multiple GC devices, or converting mixed data coming from manual entry, CSV file, and device.

GCAS Desktop runs a validity check for invalid values such as negative RF. Should it find errors, the problematic rows will display red exclamation mark on their headers and are highlighted in light red. GCAS Desktop also refuses to move onto next page unless the errors are fixed.

Ultimately, click **Next** to move onto next page and you shall see GCAS Desktop is doing its job performing ISO 10723 conversion. It may take a while if you are converting hundreds or thousands of records. When the conversion is finished, you have options to **Save as CSV**, **Export to Excel**, or **Copy to Clipboard**. The average row, if ticked in previous page, also appears in the conversion result at the very top. However it is not the actual average of conversion results you see right now, it is simply the MLC or single-point conversion of the average value of all input rows before.



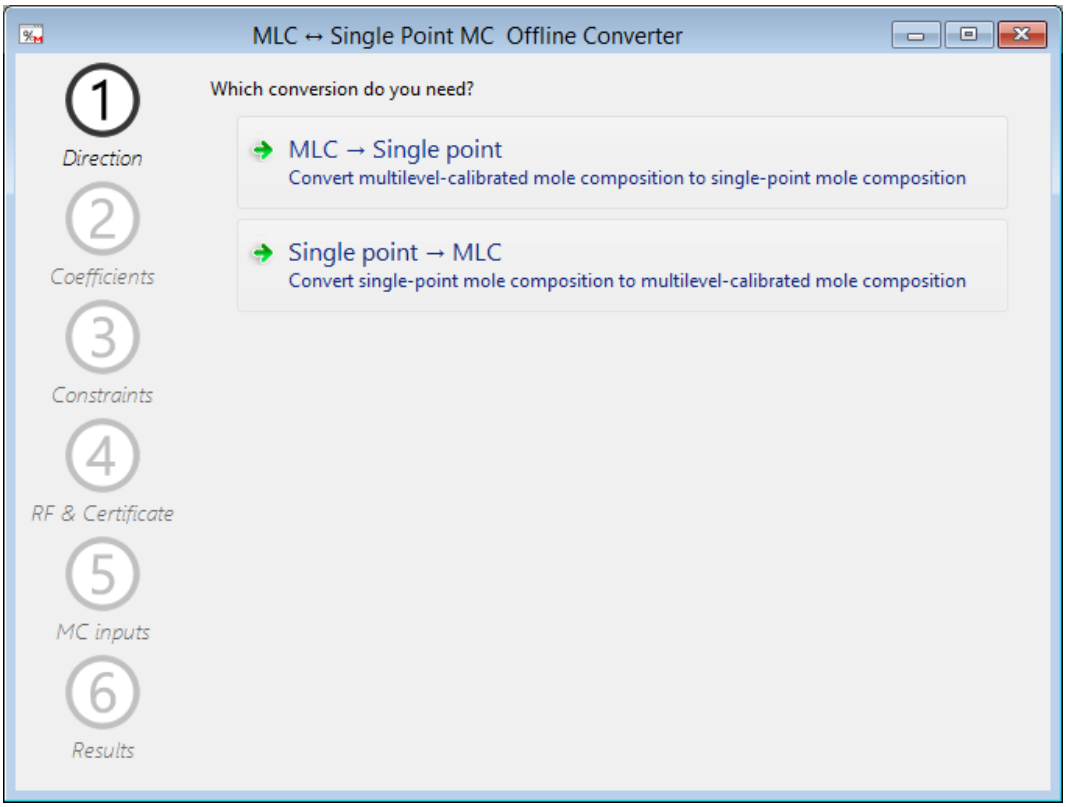
The leftmost column, **Graph**, provides a quick glance of how these converted records would look like in an RF chart. It generates a mini RF chart similar to the screenshot below. By default the chart omits zero values especially if the records don't have gases like C8, C9, or C10. You can override this behaviour by ticking **Draw zeroes**.



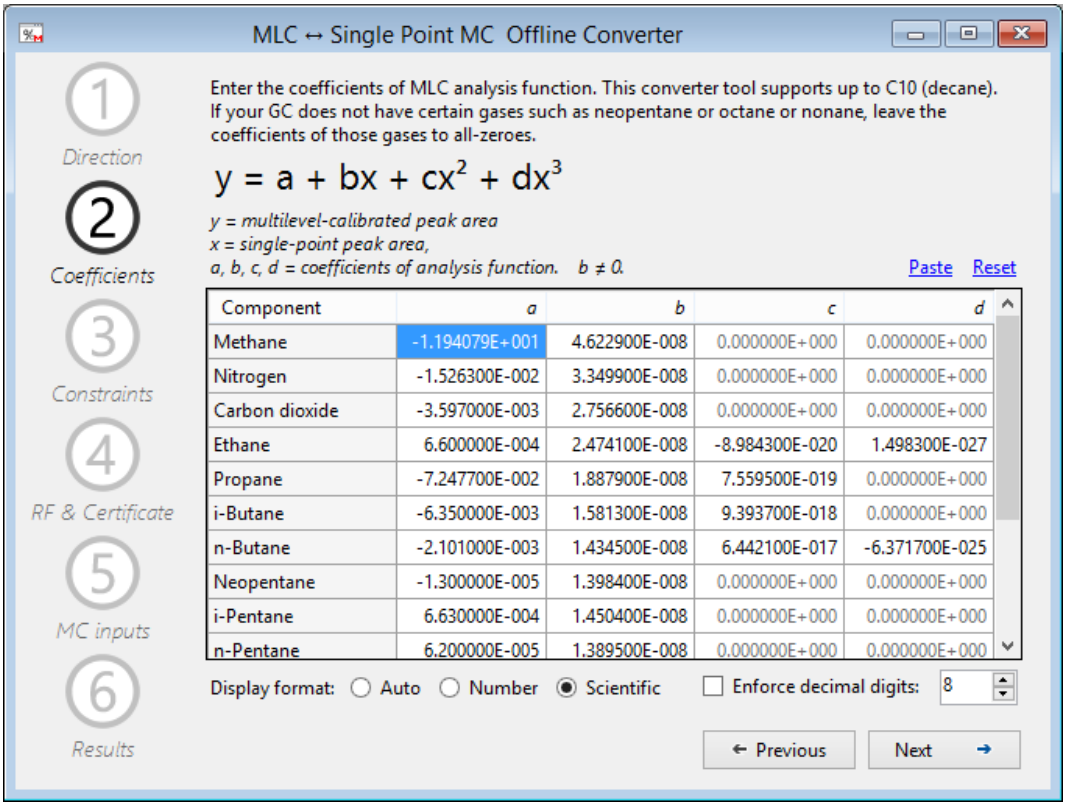
When you get a nice ascending chart for single-point RF or nice flat chart for MLC RF, most likely the three prerequisites (coefficients, certificate, and constraints) are correct. However if you get a bad chart such as one or two dots skyrocket to hundreds of millions, it may indicate one or more among the three prerequisites are wrong.

22.6.2 MLC ↔ Single-Point MC Offline Converter

This is an ISO 10723 converter tool for mole compositions. First, select a conversion direction whether from MLC to single-point or single-point to MLC.



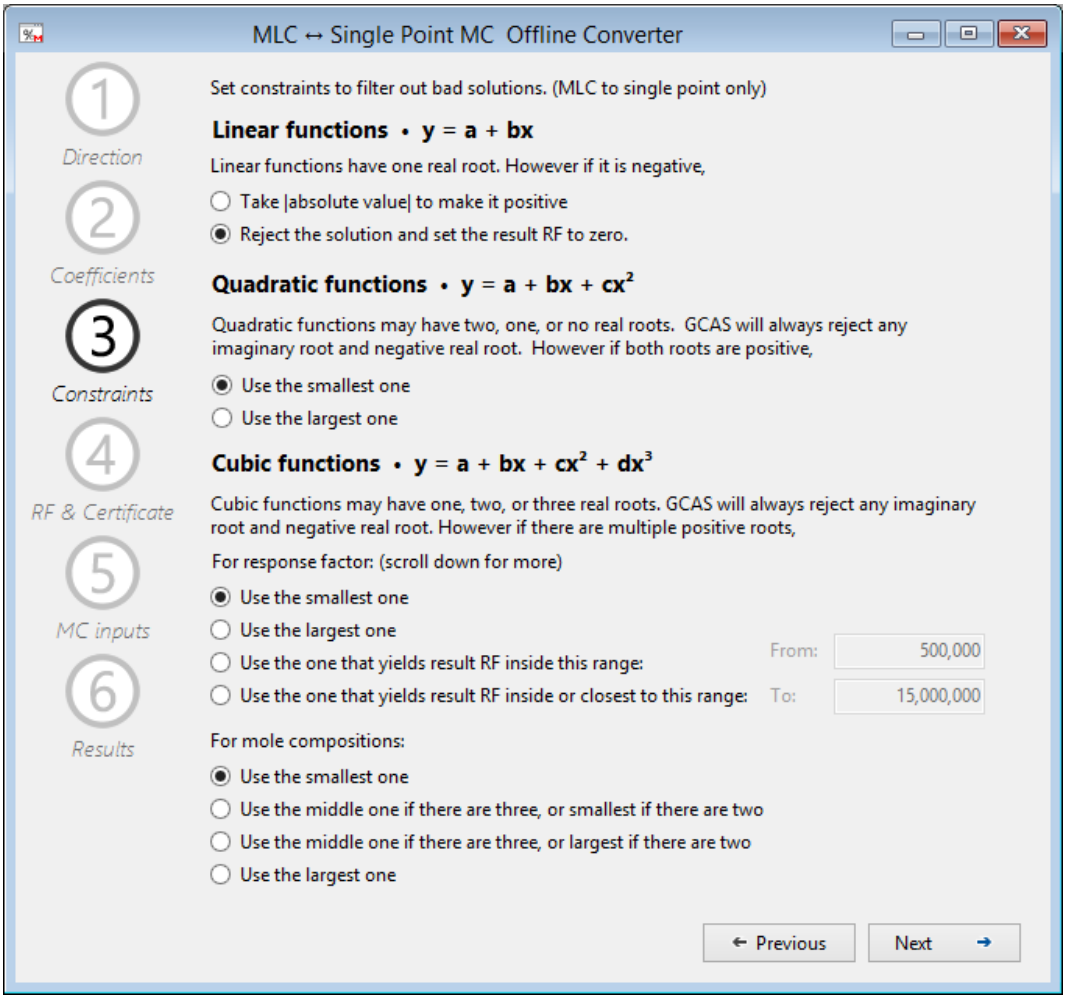
Next, enter the MLC coefficients. This page has similar layout to MLC Coefficients form. You can paste from Microsoft Excel or other spreadsheet processing software as long as the data has 4 columns and 15 rows (for 15 gases); click **Paste** to do so. If the mole composition data to convert don't have gases such as octane, nonane, decane, or neopentane, leave the coefficients of those gases to all-zeroes.


MLC ↔ Single Point MC Offline Converter
1 Direction
2 Coefficients
3 Constraints
4 RF & Certificate
5 MC inputs
6 Results
Enter the coefficients of MLC analysis function. This converter tool supports up to C10 (decane). If your GC does not have certain gases such as neopentane or octane or nonane, leave the coefficients of those gases to all-zeroes.
y = a + bx + cx² + dx³
y = multilevel-calibrated peak area
x = single-point peak area,
a, b, c, d = coefficients of analysis function. b ≠ 0.
Paste Reset
Component a b c d
Methane -1.194079E+001 4.622900E-008 0.000000E+000 0.000000E+000
Nitrogen -1.526300E-002 3.349900E-008 0.000000E+000 0.000000E+000
Carbon dioxide -3.597000E-003 2.756600E-008 0.000000E+000 0.000000E+000
Ethane 6.600000E-004 2.474100E-008 -8.984300E-020 1.498300E-027
Propane -7.247700E-002 1.887900E-008 7.559500E-019 0.000000E+000
i-Butane -6.350000E-003 1.581300E-008 9.393700E-018 0.000000E+000
n-Butane -2.101000E-003 1.434500E-008 6.442100E-017 -6.371700E-025
Neopentane -1.300000E-005 1.398400E-008 0.000000E+000 0.000000E+000
i-Pentane 6.630000E-004 1.450400E-008 0.000000E+000 0.000000E+000
n-Pentane 6.200000E-005 1.389500E-008 0.000000E+000 0.000000E+000
Display format: Auto Number Scientific Enforce decimal digits: 8
← Previous Next →

Click **Next**. Depending on conversion direction, the third page may be skipped. For MLC to single-point conversion, you are prompted to choose MLC constraints. Single-point to MLC conversion doesn't require constraints therefore this page is skipped.

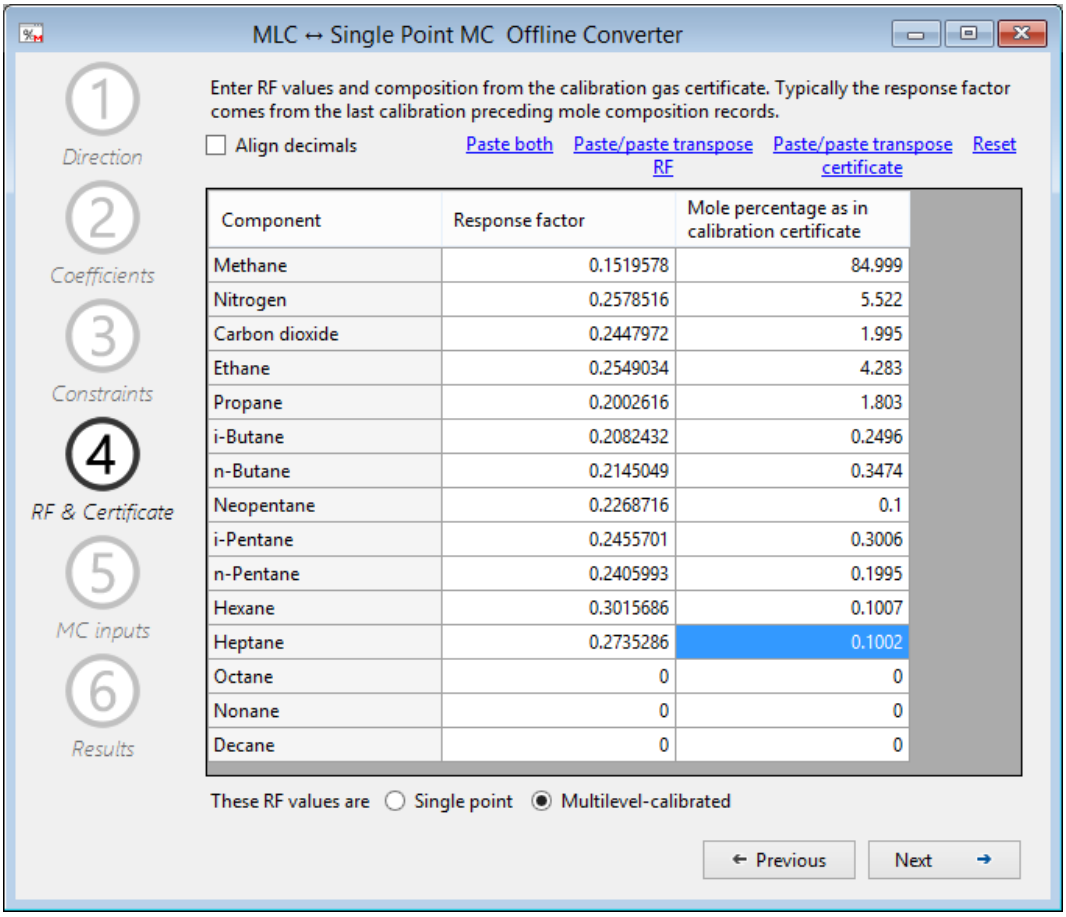
The third constraint (cubic constraint) has two parts: One for mole composition conversion, and the other for RF conversion. Mole composition conversion involves a set of RF values. These RF values must be convertible therefore they require their own MLC constraints and a calibration certificate (we'll see in the next step).

Most of the time you don't have to worry about MLC constraints and you can click **Next** straight away. However in case of the conversion results having weird values, go back to this page and change the constraints to test whether the new constraints have corrected the conversion results.


MLC ↔ Single Point MC Offline Converter
1
Direction
2
Coefficients
3
Constraints
4
RF & Certificate
5
MC inputs
6
Results
Set constraints to filter out bad solutions. (MLC to single point only)
Linear functions • y = a + bx
Linear functions have one real root. However if it is negative,
Take |absolute value| to make it positive
Reject the solution and set the result RF to zero.
Quadratic functions • y = a + bx + cx²
Quadratic functions may have two, one, or no real roots. GCAS will always reject any imaginary root and negative real root. However if both roots are positive,
Use the smallest one
Use the largest one
Cubic functions • y = a + bx + cx² + dx³
Cubic functions may have one, two, or three real roots. GCAS will always reject any imaginary root and negative real root. However if there are multiple positive roots,
For response factor: (scroll down for more)
Use the smallest one
Use the largest one
Use the one that yields result RF inside this range:
From: 500,000
Use the one that yields result RF inside or closest to this range:
To: 15,000,000
For mole compositions:
Use the smallest one
Use the middle one if there are three, or smallest if there are two
Use the middle one if there are three, or largest if there are two
Use the largest one
← Previous
Next →

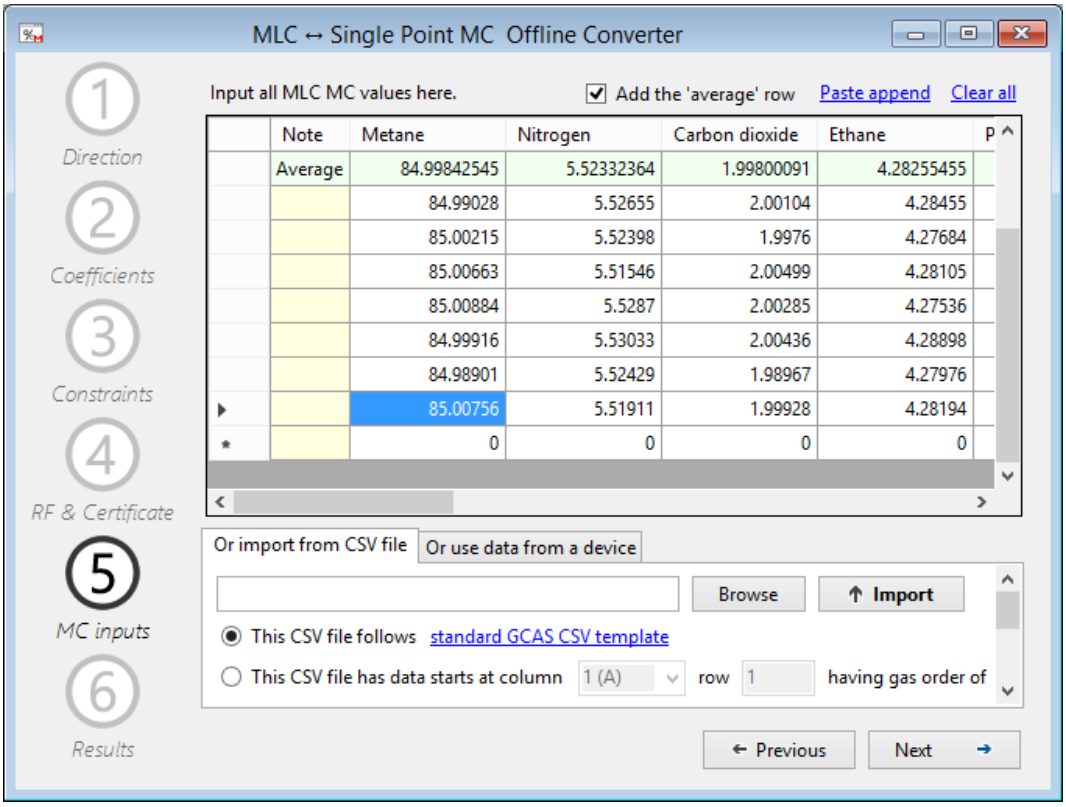
After MLC constraints, enter the mole composition part of the calibration gas certificate used by RF values followed by the RF values themselves. Save your time by copying and pasting from Microsoft Excel or other spreadsheet software. Click **Paste** if the copied data has 2 columns and 15 rows, click **Paste/paste transpose certificate** to paste calibration certificate only, or click **Paste/paste transpose RF** to paste RF values only. If the mole composition records to convert do not have gases such as neopentane, octane, nonane, or decane, leave both their certificate composition and RF values to zero.

Don't forget to specify whether the RF values are single-point or multilevel-calibrated. Under the grid, next to **These RF values are** [single-point or MLC], tick the correct radio button.



Click **Next** and you arrive at the input page. In this example, we are converting MLC composition into single-point composition. There are several ways to input mole composition (MC) values:

1. Orthodox method – typing them manually, row by row.
2. Copy and paste from Microsoft Excel or other spreadsheet processing software. Make sure the column ordering is correct as you may end up with wrong composition values in wrong gas. Click **Paste append** to paste from clipboard into new rows. Existing rows are not affected.
3. Import from CSV – please specify whether the CSV file follows standard GCAS CSV template or a custom template. Keep reading after the screenshot below.
4. Import from GC device in database – select a GC device, date range, and the stream number too. More about this later.

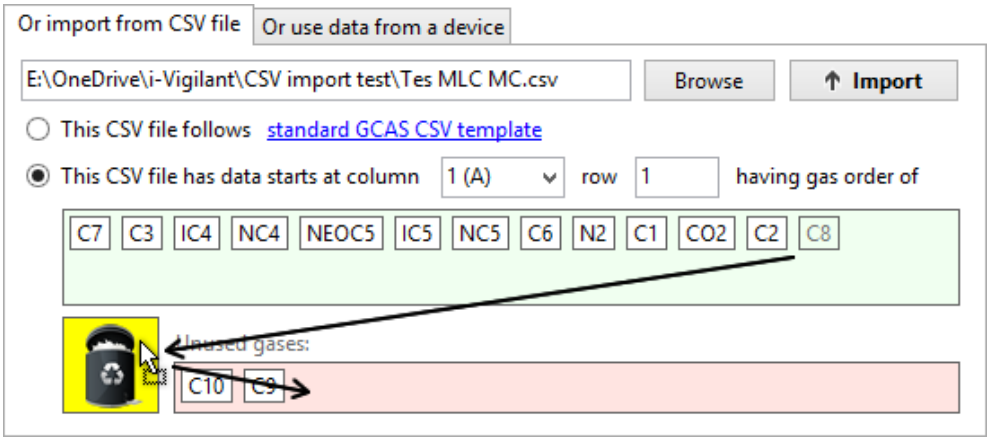


Above the grid there is a check box called **Add the 'average' row**. This check box inserts a special row at the very top, which contains the averaged value of all rows below it. Average row will be converted to MLC or single-point too, depending on selected direction during the first page. If you delete some rows or edit some rows or append new rows into this grid, the average values are updated automatically.

All numbers in this grid are treated as *unnormalised*. GCAS Desktop normalises them before performing ISO 10723 conversion.

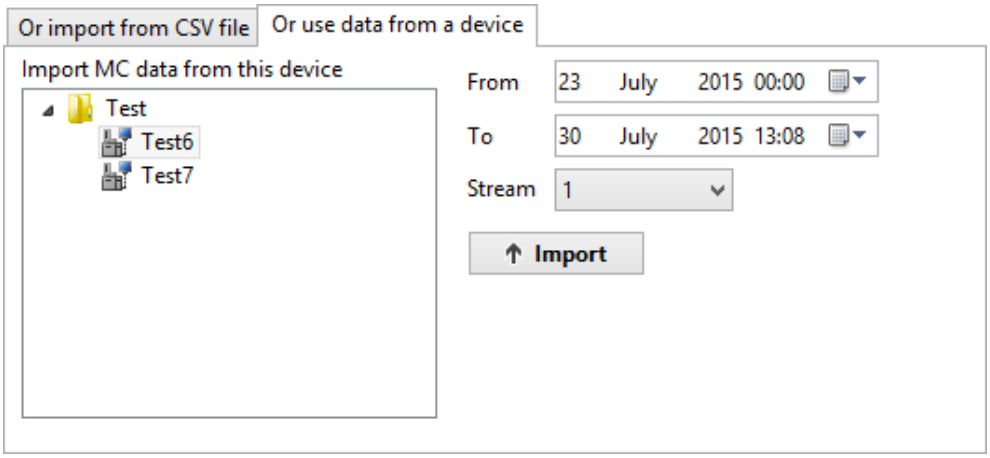
For CSV import, select whether the CSV file follows the standard template or you are using your own CSV file. Select the second radio button for CSV files with additional columns before the first gas, or with additional header rows before the first row, or with different gas ordering, or combination of these. Define at which column and which row do the actual data start. If necessary, change the gas order definition to match your CSV file.

Reorder those gases using drag-and-drop operation inside the green area. Had there any gases not present in your CSV such as octane/C8, nonane/C9, or decane/C10, drag them to the trash bin icon and they will move to the *unused gases* (pink) area. Drag gases out of the pink area back into the green area to reuse them if necessary.


Or import from CSV file
Or use data from a device
E:\OneDrive\i-Vigilant\CSV import test\Tes MLC MC.csv
Browse
Import
This CSV file follows standard GCAS CSV template
This CSV file has data starts at column 1 (A) row 1 having gas order of
C7 C3 IC4 NC4 NEOC5 IC5 NC5 C6 N2 C1 CO2 C2 C8
Unused gases:
C10 C9

Finally, click **Import**. GCAS Desktop reads your CSV file and appends data into new rows. Existing rows are not affected. Also the converter form reveals an additional column named **Notes** and writes the CSV file name followed by row number.

For data import from a GC device, select the device followed by the desired date/time range and the stream number. Click **Import** and GCAS Desktop will query GCAS database to get these records.

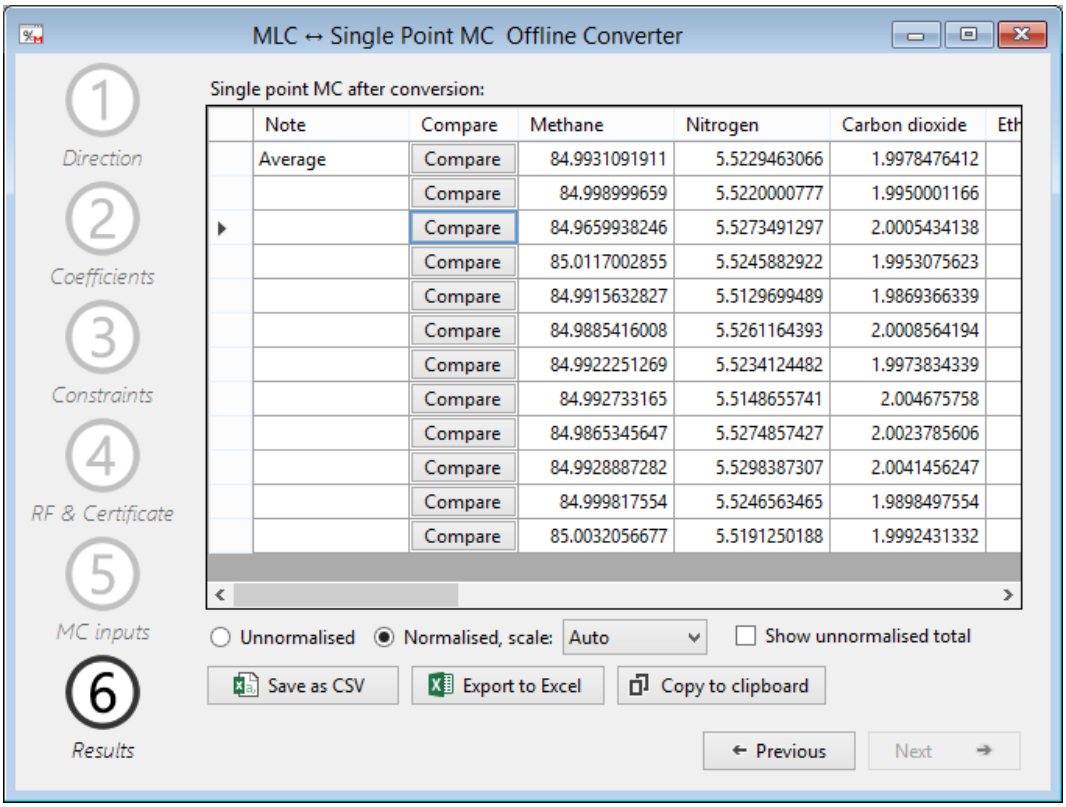


The converter form reveals the **Notes** column and writes device tag name followed by record timestamps. These notes helps you differentiate which rows belong to which device in case you are converting bulk records from multiple GC devices, or converting mixed data coming from manual entry, CSV file, and device.

GCAS Desktop runs a validity check for invalid values such as negative composition. However, there is no check if sum of a composition record exceeds 100 because the record may be on a different scale, not percentage. If GCAS Desktop finds errors, the problematic rows will display red exclamation mark on their headers and are highlighted in light red. GCAS Desktop also refuses to move onto next page unless the errors are fixed.

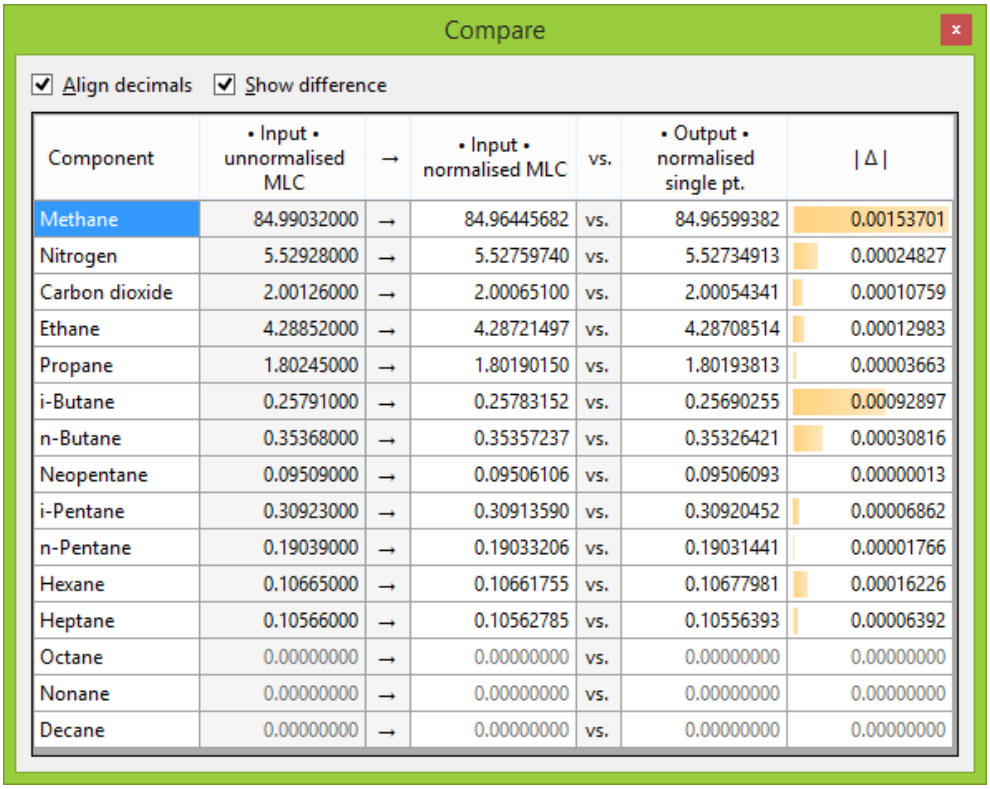
Ultimately, click **Next** to move onto next page and you shall see GCAS Desktop is doing its job performing ISO 10723 conversion. It may take a while if you are converting hundreds or thousands of records. When the conversion is finished, you have options to **Save as CSV**, **Export to Excel**, or **Copy to Clipboard**. The average row, if ticked in previous page, also appears in the conversion result at the

very top. However it is not the actual average of conversion results you see right now, it is simply the MLC or single-point conversion of the average value of all input rows before.



By default, the displayed result is normalised. Check **Show unnormalised total** to reveal the unnormalised total column (after decane). Select the radio button **Unnormalised** or **Normalised** to flip all numbers between the two.

Unlike RF converter, MC converter provides **Compare** column which contains buttons to compare normalised input (before conversion) versus normalised output (after conversion). These buttons call the *Compare* tool window similar to the screenshot below. Check **Show difference** to reveal the absolute delta column, which is the absolute value of difference/bias between input composition and conversion result.



Component	• Input • unnormalised MLC	→	• Input • normalised MLC	vs.	• Output • normalised single pt.	| Δ |
Methane	84.99032000	→	84.96445682	vs.	84.96599382	0.00153701
Nitrogen	5.52928000	→	5.52759740	vs.	5.52734913	0.00024827
Carbon dioxide	2.00126000	→	2.00065100	vs.	2.00054341	0.00010759
Ethane	4.28852000	→	4.28721497	vs.	4.28708514	0.00012983
Propane	1.80245000	→	1.80190150	vs.	1.80193813	0.00003663
i-Butane	0.25791000	→	0.25783152	vs.	0.25690255	0.00092897
n-Butane	0.35368000	→	0.35357237	vs.	0.35326421	0.00030816
Neopentane	0.09509000	→	0.09506106	vs.	0.09506093	0.00000013
i-Pentane	0.30923000	→	0.30913590	vs.	0.30920452	0.00006862
n-Pentane	0.19039000	→	0.19033206	vs.	0.19031441	0.00001766
Hexane	0.10665000	→	0.10661755	vs.	0.10677981	0.00016226
Heptane	0.10566000	→	0.10562785	vs.	0.10556393	0.00006392
Octane	0.00000000	→	0.00000000	vs.	0.00000000	0.00000000
Nonane	0.00000000	→	0.00000000	vs.	0.00000000	0.00000000
Decane	0.00000000	→	0.00000000	vs.	0.00000000	0.00000000

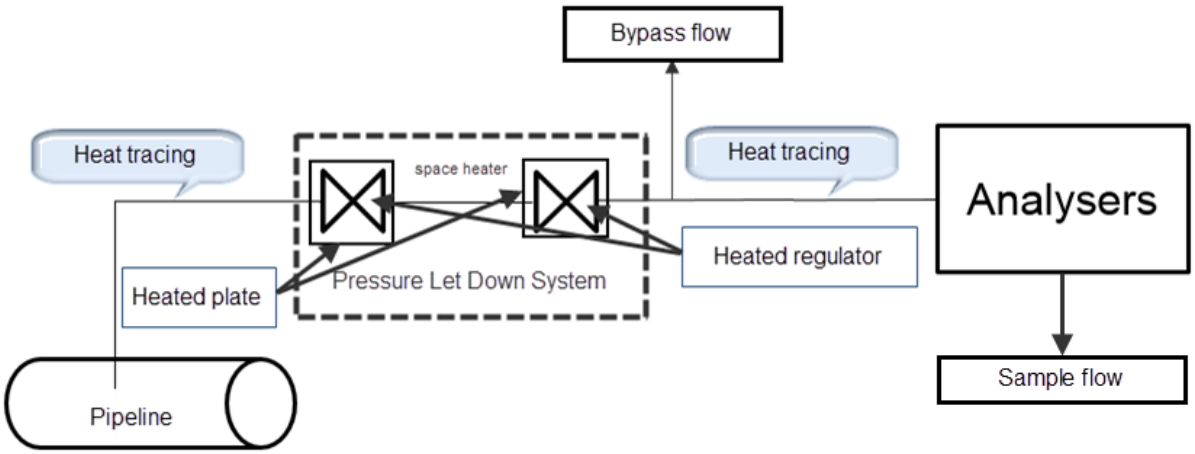
22.7 Low-Level ISO 10723 Implementation

Provided the GCAS feature *ISO 10723* is included in your licence, you already have ISO 10723 features in relevant modules such as Footprint, Calibration Data, Mole Composition, Data Analysis, Dashboard, and pretty much everything that uses response factor values or mole composition values. GCAS Desktop always checks the MLC flag bit of calibration or mole composition records and performs necessary actions before those modules use these records. For example, you cannot get a valid uncertainty of reproducibility from a collection of multilevel-calibrated RF. Therefore, in order to calculate $U_{reproducibility}$ GCAS Desktop needs to convert the RF records into single-point first. This is done on-the-spot and behind the screen. You didn't notice the Dashboard always gives correct R^2 value even though all calibration data are marked as MLC, did you?

Visit the appropriate chapter on the module to get help about ISO 10723 features. Footprint and calibration data are on chapter 7, Mole Composition is on chapter 8, Data Analysis is on chapter 10, and Mole Composition Comparison is on chapter 17.

23 Lag Time

Lag time is the total time of gas stream measured from the time it is sampled at the main pipeline to the time it exits the detector of your GC. After leaving the sample probe, the gas enters *pressure letdown system* to have its pressure reduced in order to be safe for the GC. The pressure letdown system is series of regulators, heating elements, and pipes with different diameter and length, which affect the travel time. Not to mention the GC device itself has a predefined cycle time and analysis time. Therefore when the gas finally reaches the detector within GC, it is not the same gas travelling inside main pipeline at the same exact moment. It can range from several minutes to few hours behind the pipeline.



Typical pressure letdown systems.

Lag time is used by spot samples. Its main purpose is to shift the date and time of the spot sample record. Spot sample values are then compared to the nearest mole composition data at the timestamp of spot sample *plus lag time*. Without lag time taken into account, spot sample will precede the mole composition record by several minutes to few hours ahead, making the spot sample values stay afar from the mole composition record. Hence, you cannot use it (or it becomes more difficult) to determine the health status of your pressure letdown system.

Lag time is calculated per-*stage* and summed together at the end. One *stage* is one configuration of pipes and regulators. Typical pressure letdown system may have three to four stages, which in turn makes typical lag time calculation has five or six stages in total.

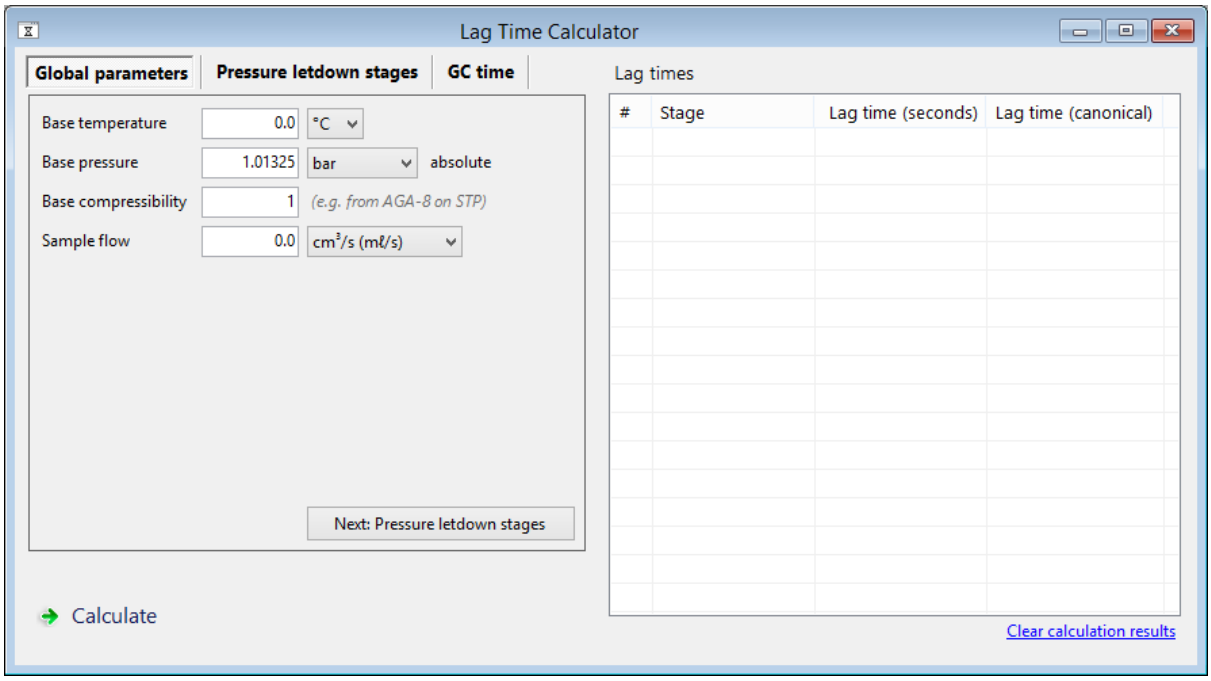
Note

This module requires GCAS feature *Lag Time Calculator* to be included in GCAS licence.

23.1 The *Lag Time Calculator* Form

Lag Time Calculator form takes your *stage data* as input then calculates the lag time as output. Lag Time Calculator form is designed for two uses, offline calculation and device-bound calculation. Yet, in current version of GCAS Desktop at the time this document is written (version 1.8.1.0) the device-bound calculation is not yet implemented. For the time being, Lag Time Calculator handles offline calculation only. Offline calculation is one-time calculation that is not tied to any devices in GCAS database.

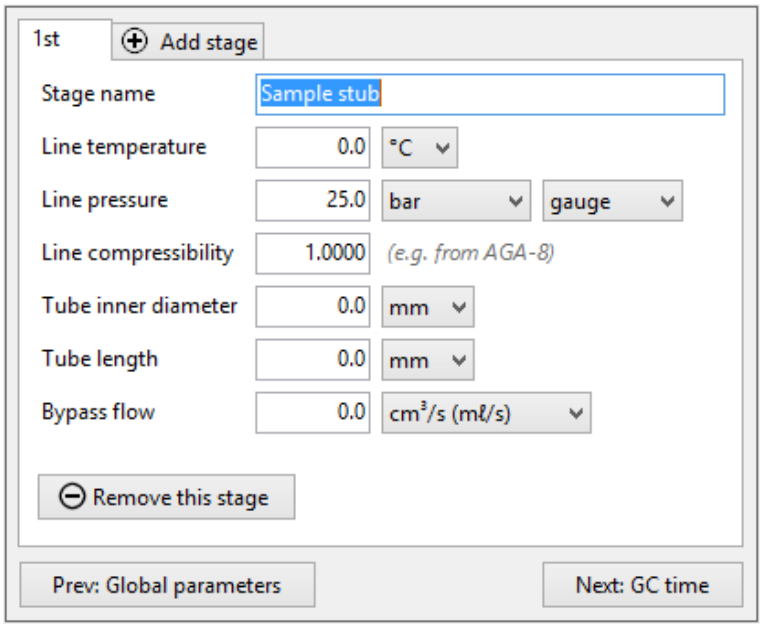
Go to the Tools menu and select **Lag Time Calculator**.



Left side of the form are the inputs, while right side is the output. The input section consists of three tabs: Global parameters, pressure letdown stages, and GC time.

Global parameters have four inputs: Base temperature, base pressure, base compressibility, and sample flow. Base temperature is set at 0°C and base pressure is typically set at the atmospheric pressure (1 atm or 1.01325 bar). You need to provide the base compressibility factor (Z) and sample flow. When it's done, click **Next: Pressure letdown stages** to move onto the next tab.

Pressure letdown stages are the collection of stage data. A *stage data* consists of 7 inputs: stage name, line temperature, line pressure, line compressibility, tube inner diameter, tube length, and bypass flow.



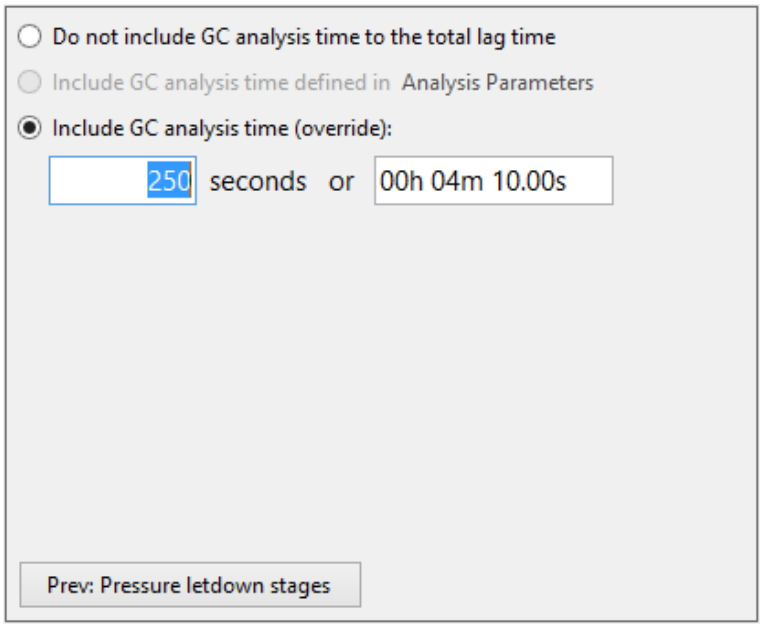
- **Stage name**: Enter a name as an identifier to distinguish this stage from other stages. This name will appear in the first column of the output list.
- **Line temperature**: Temperature at this pipe.
- **Line pressure**: Pressure at this pipe as conditioned by the regulator.
- **Line compressibility**: The compressibility factor (Z) of the gas at this stage.
- **Tube inner diameter**: Inside-diameter of this pipe.
- **Tube length**: Total length of the pipe.
- **Bypass flow**: How much gas being discarded before entering the next stage.

One stage data is contained in one tab. To add more stage, open the last tab (**Add stage**) then the form automatically creates a new tab for you. To remove a stage, click **Remove this stage** at bottom-left corner of a tab.

Note

You can add up to 32 stages maximum.

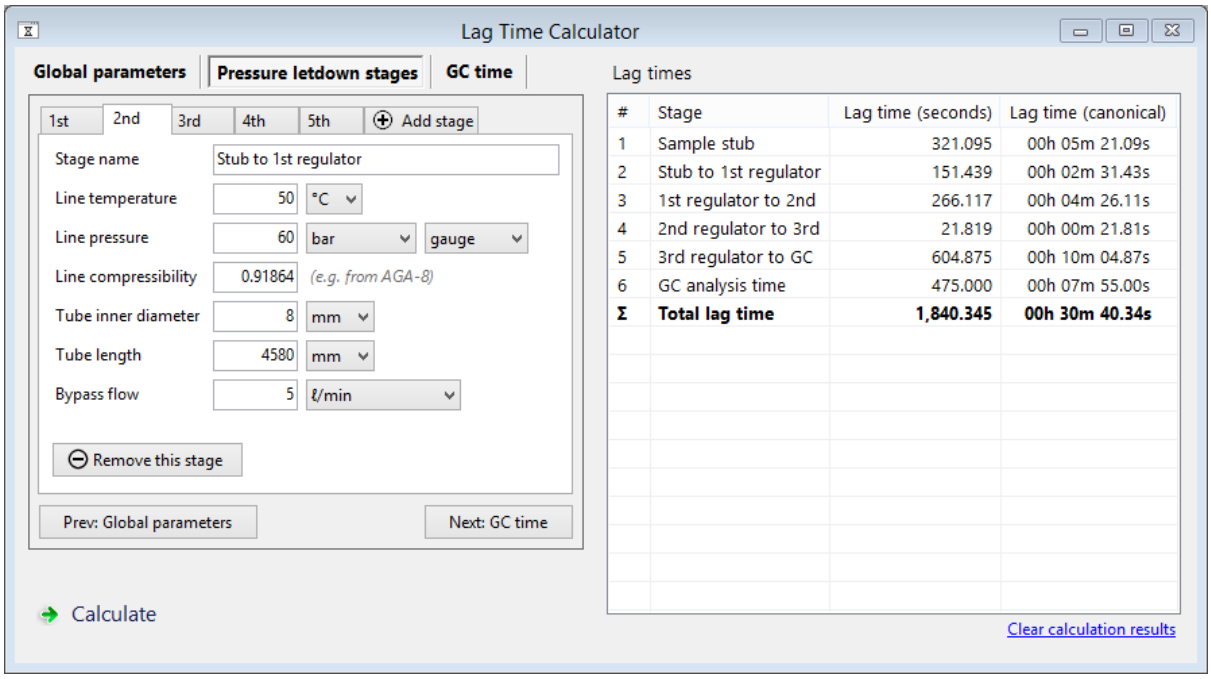
When you finished entering all stage data, click **Next: GC time** to move onto next tab.


Do not include GC analysis time to the total lag time
Include GC analysis time defined in Analysis Parameters
Include GC analysis time (override):
250
seconds or
00h 04m 10.00s
Prev: Pressure letdown stages

GC time is cycle time plus analysis time of the GC device. This time value is added to the total lag time so far, but you have the option not to include GC analysis time if desired.

The second radio button is disabled because Lag Time Calculator form is in offline calculation mode. This option is intended for device-bound calculation mode which is not yet available in GCAS Desktop version 1.8.1.0

Pay attention to units of measurement as wrong unit will produce wrong result. When you are ready, click **Calculate** at the bottom-left corner of the form. Lag Time Calculator computes the lag time and displays the calculation result in the list view on the right hand side. Total lag time is displayed in bold face.



Click **Clear calculation results** to empty the list and start over.

23.2 The *Lag Time* Form

Under construction.

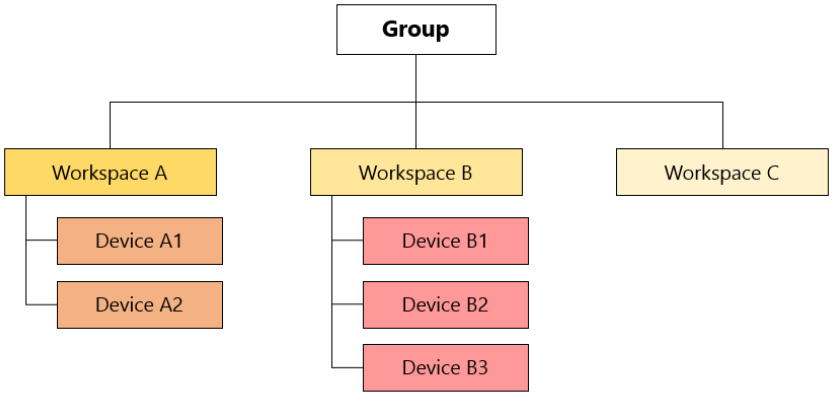
Lag Time form is a planned record viewer form of lag time records tied to GC devices. Because device-bound lag time calculation is not yet finished, Lag Time form is not yet available. When this feature is implemented, Lag Time form will be accessible from the View menu.

One lag time record may survive for years because users need to calculate lag time when they change the piping or the design of pressure letdown systems, or when they replace the GC device.

The only module using lag time data is Data Analysis. It is used when the user wants a mole composition trend, then ticked **Include spot samples**. By subsequently ticking **Apply lag time**, all spot sample dots on the chart will shift to the right by the amount of total lag time.

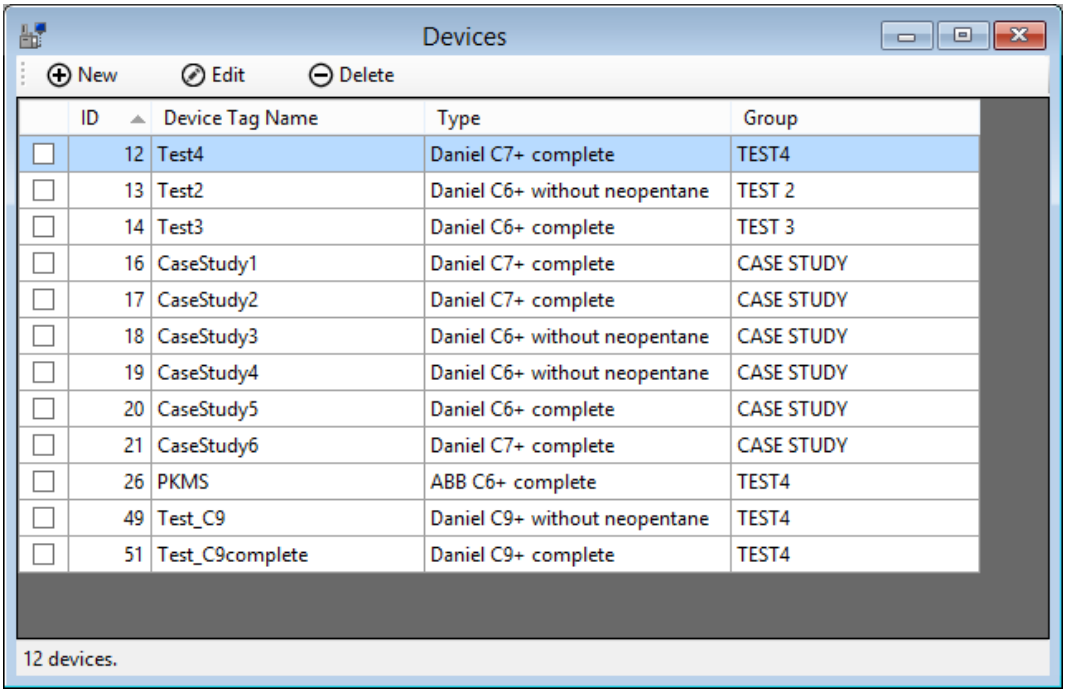
24 Device Management

A *device* is a representation of an actual, physical GC device. Device in GCAS database has several properties for example device name (also known as *device tag*), device type, and device date format (whether American or rest-of-the-world format). These properties should match the actual configuration of your physical GC device. Managing devices are conducted through the Devices form. Default installation of GCAS specifies only GCAS administrator and super users have access to this form.



- One group has several workspaces.
- Workspaces are a way to separate devices in the same group. This has been covered in chapter 3.2 Groups and workspaces.
- One device must belong to one workspace.

24.1 The *Devices* Form


Devices
New
Edit
Delete
ID
Device Tag Name
Type
Group
12 Test4 Daniel C7+ complete TEST4
13 Test2 Daniel C6+ without neopentane TEST 2
14 Test3 Daniel C6+ complete TEST 3
16 CaseStudy1 Daniel C7+ complete CASE STUDY
17 CaseStudy2 Daniel C7+ complete CASE STUDY
18 CaseStudy3 Daniel C6+ without neopentane CASE STUDY
19 CaseStudy4 Daniel C6+ without neopentane CASE STUDY
20 CaseStudy5 Daniel C6+ complete CASE STUDY
21 CaseStudy6 Daniel C7+ complete CASE STUDY
26 PKMS ABB C6+ complete TEST4
49 Test_C9 Daniel C9+ without neopentane TEST4
51 Test_C9complete Daniel C9+ complete TEST4
12 devices.

Go to the Subscription menu > **Devices**. This form lists all GC devices from all groups assigned to your user account.

Note

Default installation of GCAS Desktop specifies that you have to be at least a *super user* to access this form.

24.1.1 Create, Edit, Delete Devices

24.1.1.1 Create a New Device

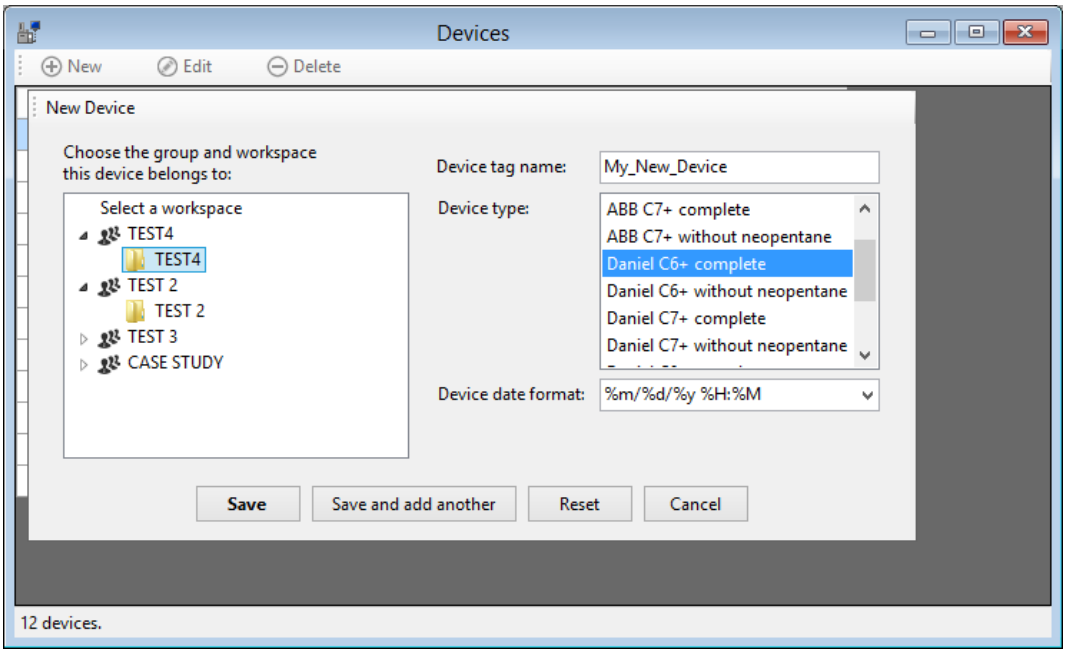
Click **New** on the toolbar to create a new device.

Note

Your GCAS licence specifies how many devices you can create. You cannot create more devices than this limit, and also if you try to open a GCAS database containing number of devices exceeding this limit, you need to choose devices to be accessible during that session.

Important

If you use the old GCAS licence version 2, the limit of GC devices you can have is 10 (ten).



Using the tree view on the left side, choose the group and workspace where the new device will belong to. Expand a group node to see workspaces within this group, and click a workspace to select it. The new device will be created under this workspace.

On the right side, there are three main properties of the new device.

Device tag name is device name that will appear on the device panel on the main user interface. It is a good practice to keep the tag name unique for each device.

Device type: Select one from the list that matches your physical GC devices (applies to both Daniel and ABB).

Device type	C1	C2	C3	IC4	NC4	NEO C5	IC5	NC5	C6	C7	C8	C9	C10	N2	CO2
C6+ complete	•	•	•	•	•	•	•	•	•					•	•
C6+ without neopentane	•	•	•	•	•		•	•	•					•	•
C7+ complete	•	•	•	•	•	•	•	•	•	•				•	•
C7+ without neopentane	•	•	•	•	•		•	•	•	•				•	•
C9+ complete	•	•	•	•	•	•	•	•	•	•	•	•		•	•
C9+ without neopentane	•	•	•	•	•		•	•	•	•	•	•		•	•
C10+ complete	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
C10+ without neopentane	•	•	•	•	•		•	•	•	•	•	•	•	•	•

Help on abbreviations: go to chapter 6. C-number glossary
Additional glossary: N2 = nitrogen, CO2 = carbon dioxide.

Device date format: Select one of the list, or type a custom date format. This date format follows MySQL convention. We recommend to select from the dropdown list.

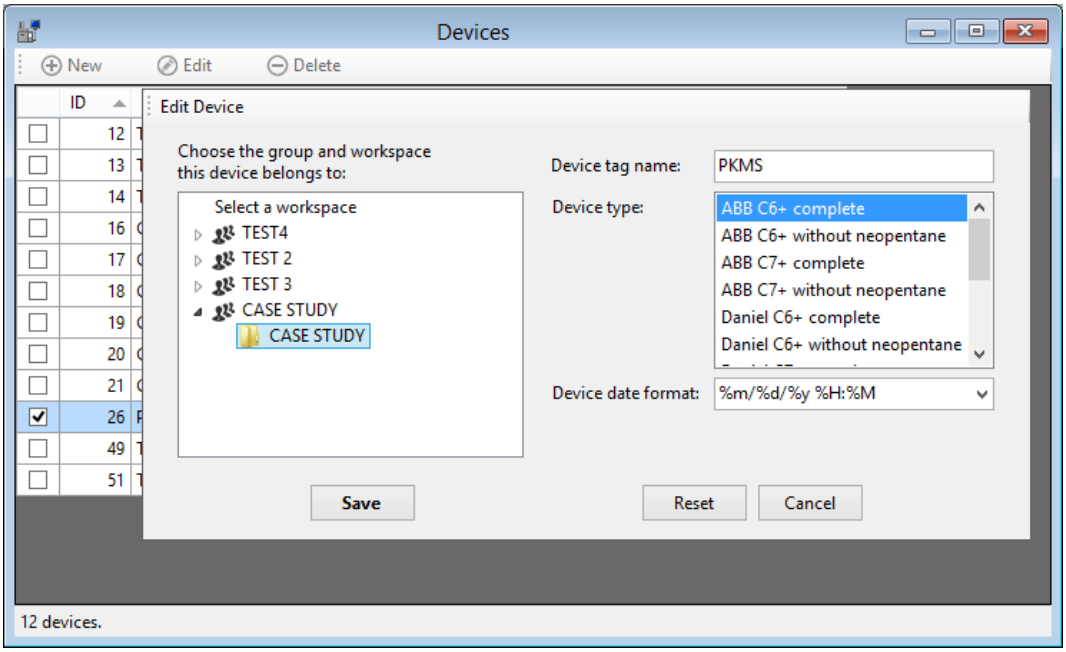
- **%m/%d/%y %H:%M** = USA format. For instance, 01/12/2013 07:55 is interpreted as 12 January 2013 07:55 AM.
- **%d/%m/%y %H:%M** = rest-of-the-world format. For example, 01/12/2013 07:55 translates to 1 December 2013 07:55 AM.

Custom format specifier	Date/time element
%d	date (2 digits)
%m	month (2 digits)
%y	year (4 digits)
%H	hour (2 digits, 24h format)
%M	minute (2 digits)

When you are finished, click **Save** or **Save and add another** to set up the new device inside GCAS database.

24.1.1.2 Edit an Existing Device

To edit a device, tick the device on the grid then click the **Edit** button. Make the change as required and finally click **Save**. Visit previous section if you need help about how to edit a particular field. You might need to click **Refresh Devices** on the main interface for the change to take effect.



If you change the workspace, the device will be moved into new workspace, or even new group. This is one way to reorganise devices, however it moves only one device at a time. To move multiple devices more efficiently, visit chapter 24.1.2 Reorganise Multiple Devices.

Important

You need to reconfigure modbus register mappings of this device, if there's one defined for it, when you change the device type. Not doing so will cause many modules to display values under wrong gas names.

24.1.1.3 Delete Devices

Tick the device(s) you would like to delete. You can tick multiple devices together for bulk deletion. Next, click **Delete** button on the toolbar.

Important

Deleting devices will erase:

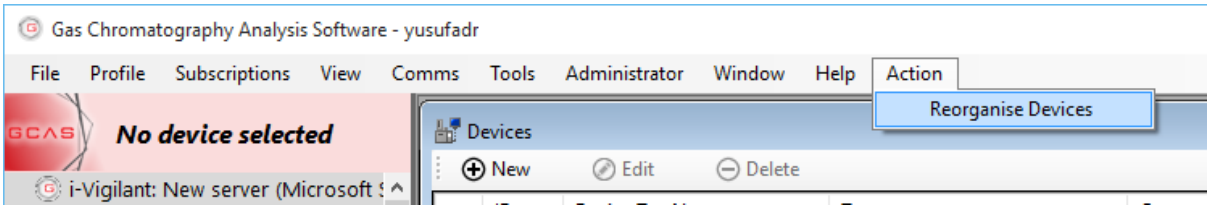
- All footprints and calibration data of these devices,
- All mole composition data of these devices,

- All calibration gas certificates of these devices,
- Analysis parameter record for these devices,
- All uncertainty coefficients for these devices,
- All multilevel calibration coefficients for these devices,
- All multilevel calibration constraints for these devices,
- All lag time data for these devices,
- All comments made for these devices, and
- All repeatability test data of these devices (for i-Vigilant central database and GCAS Web users).

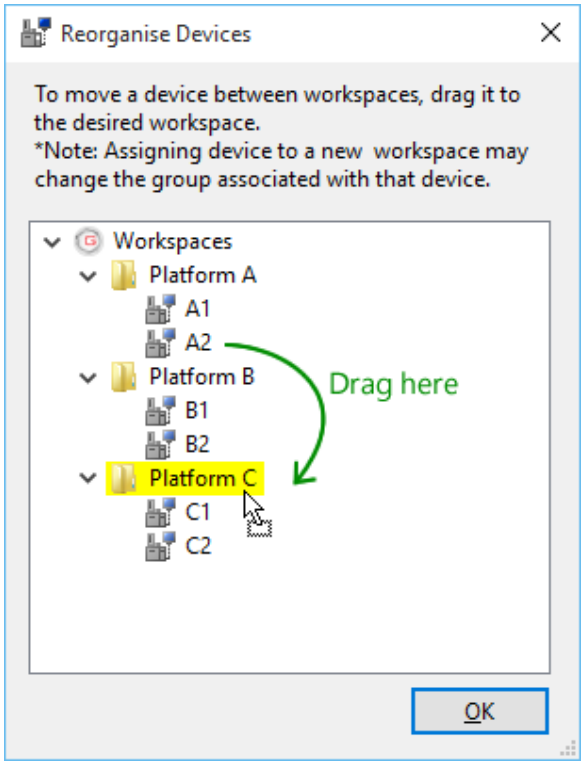
The deletion is **permanent** and cannot be undone. Make sure you no longer use the existing data when you delete these devices. Otherwise, export their data as a backup.

24.1.2 Reorganise Multiple Devices

To move multiple GC devices between workspaces within the same group or to another workspace belong to other group, open the Devices form and notice the Action menu on the menu bar.



Open the Action menu and select **Reorganise Devices**. This will show the *Reorganise Devices* dialogue. Drag the device you would like to move to the new workspace. Changes are committed automatically to the database. This method is faster than editing multiple devices one by one only to change their assigned workspaces. Click **OK** and the main window shall reload its device list.


Reorganise Devices
To move a device between workspaces, drag it to the desired workspace.
*Note: Assigning device to a new workspace may change the group associated with that device.
Workspaces
Platform A
A1
A2
Platform B
B1
B2
Platform C
C1
C2
Drag here
OK

25 Data Capture

Instead of relying on CSV or text file import, GCAS Desktop has the ability to connect to your physical GC device via Modbus® protocol in order to get live data. GCAS Desktop captures response factor, retention time, and mole composition data.

Note

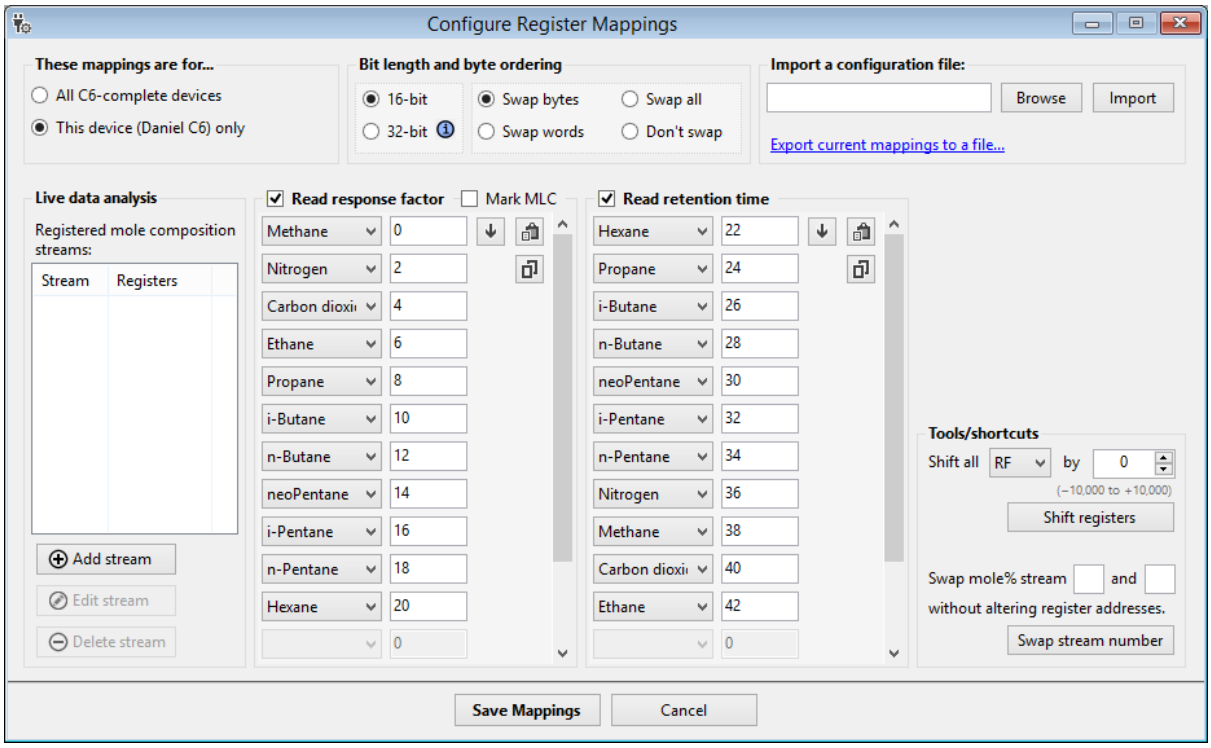
To use this feature, you need the GCAS feature either *Modbus over Serial* or *Modbus over TCP* (or both) to be included in your GCAS licence. Additionally, to capture mole composition data you need another GCAS feature *Live Data Analysis* in your GCAS licence.

25.1 Configure Register Mappings

Before GCAS Desktop captures live data, you need to configure the Modbus registers. *Register* is small, volatile memory storage where your GC device outputs the data to. GCAS Desktop reads *holding registers* on your GC device, therefore please configure your GC device to write the data to Modbus register 4xxxx. On GCAS side, configure GCAS Desktop to match those register addresses. This is administered through Register Mappings form.

25.1.1 The *Register Mappings* Form

Select the device you would like to configure on your device panel on the main interface. Then, click the Comms menu > **Register Mappings**.

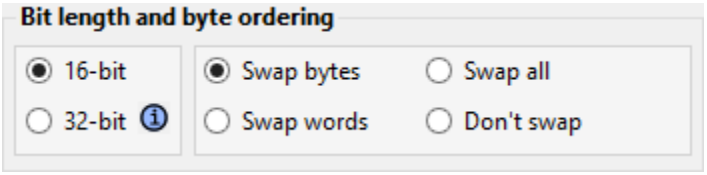


When the form opens, it tries to find the device configuration if you have ever configured it before. The configuration is stored in an XML file in `[Installation directory]\Mappings-DeviceSpecific\` folder. If the corresponding XML file does not exist—implies that the device has never been configured, the form loads the appropriate **template**. The template being used depends on your GC device type.

Now you are ready to configure the register addresses for calibration data and for mole analysis data.

25.1.2 Bit Length and Byte Ordering

A standard Modbus register is 16 bits long, or 2 bytes. However, a standard single-precision IEEE-754 floating point representation requires 32 bits, or 4 bytes. Two Modbus registers are then used to output a single floating-point datum. The floating point standard dictates how the bytes in these two register be arranged to construct a 4-byte floating point value.



Several GC devices such as Daniel and Enron implement a non-standard Modbus protocol extension which uses 32-bit Modbus registers, or 4 bytes for each register. GCAS Desktop supports these 32-bit registers as well. Choose **16-bit** to use standard 16-bit Modbus registers or **32-bit** to use non-standard 32-bit registers.

Depending on how your GC device is configured, you need to match the byte ordering configuration on GCAS Desktop. Select one of four byte ordering options:

- **Swap bytes**, also known as Modicon standard, swaps the bytes within each word (ABCD → BADC).
- **Swap words** swaps low and high word but not bytes inside each word (ABCD → CDBA).
- **Swap all** swaps both words and bytes inside words (ABCD → DCBA).
- **Don't swap** preserves the original byte order (ABCD → ABCD).

25.1.3 Calibration Parameter Registers

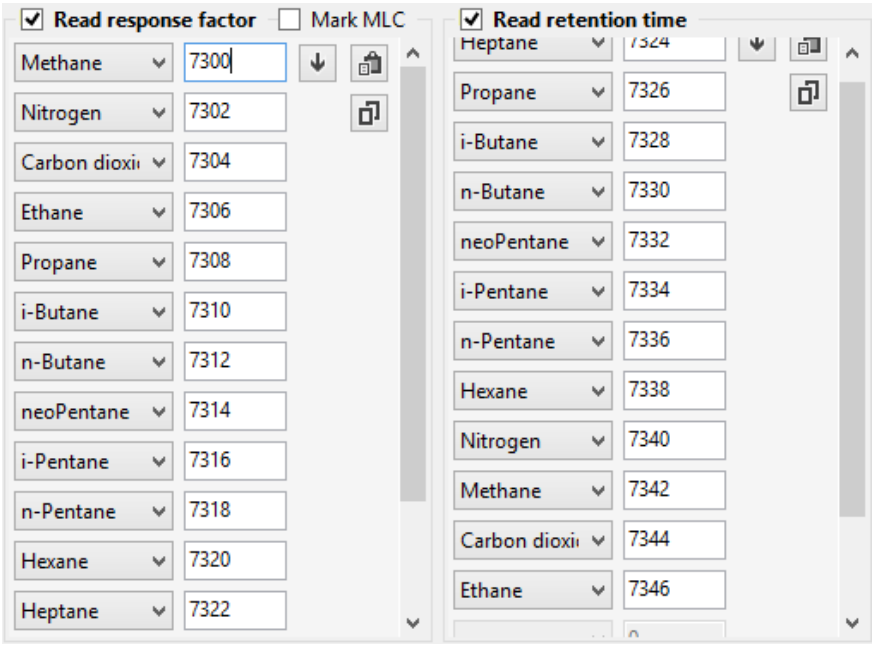
Calibration parameter refers to response factor and retention time. On Register Mappings form, set the registers for RF and RT data to match those on your physical GC device. Register address starts from `0` (zero). Address `0` translates to Modbus holding register `40001`. Address `1` translates to `40002`, and so on.

Change the gas order by selecting the correct gas names from the dropdown list. Depending on your GC device type, one to five bottommost input fields may be disabled. For instance, a GC device of C7+ without neopentane only reads 11 gases. Therefore, twelfth to fifteenth input fields would be greyed out.

Ignore a part of incoming data

You can make GCAS Desktop *ignore* incoming RF data, for example, if you want to capture retention time only or mole composition streams only. To ignore response factor data, untick **Read response factor**. The same applies for RT data, which you can control using **Read retention time** tick box.

On standard **16-bit** Modbus, one gas requires two Modbus registers. For instance in the screenshot below, methane RF is set to use register address `7300`. In practice, it uses register address `7300` and `7301` altogether. Set the next gas/nitrogen RF register to address `7302`.



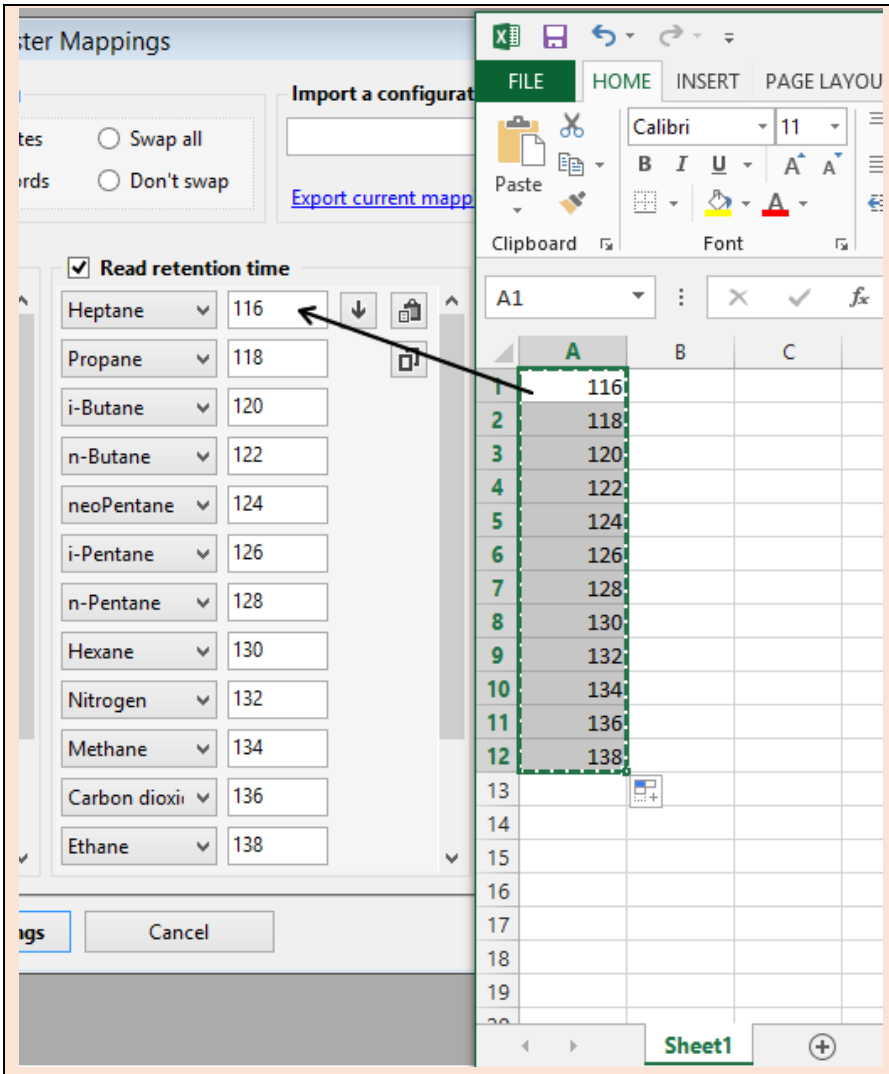
However in **32-bit** Modbus, one gas requires only one register. There is no need to skip register address once every two like in the prior example.

Users with GCAS feature *ISO 10723* included in their licences see an additional check box at the header of response factor fields called **Mark MLC**. This controls whether the incoming response factor data should be marked as multilevel-calibrated or not. Rewind to chapter 7.11 to read more about multilevel-calibrated RF.

Tip

To quickly define sequential Modbus registers, enter the first register address then click **Flash fill**. For example, type `110` in methane response factor, click **Flash fill**, and GCAS Desktop shall assign `112` for nitrogen response factor, `114` for carbon dioxide, `116` for ethane, and so on. If you are on 32-bit Modbus then GCAS Desktop assigns `111` for nitrogen, `112` for carbon dioxide, `113` for ethane, and so on.

You can also copy Modbus register addresses from Microsoft Excel or other spreadsheet processing software. Press `Ctrl+V` inside the **first text box** and the rest will follow. Alternatively, click **Paste**.



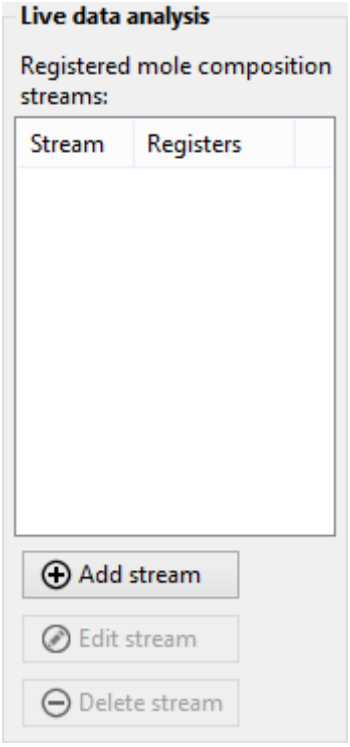
The **Copy** button does the opposite—it copies register addresses from GCAS Desktop so you can paste onto Microsoft Excel spreadsheet.

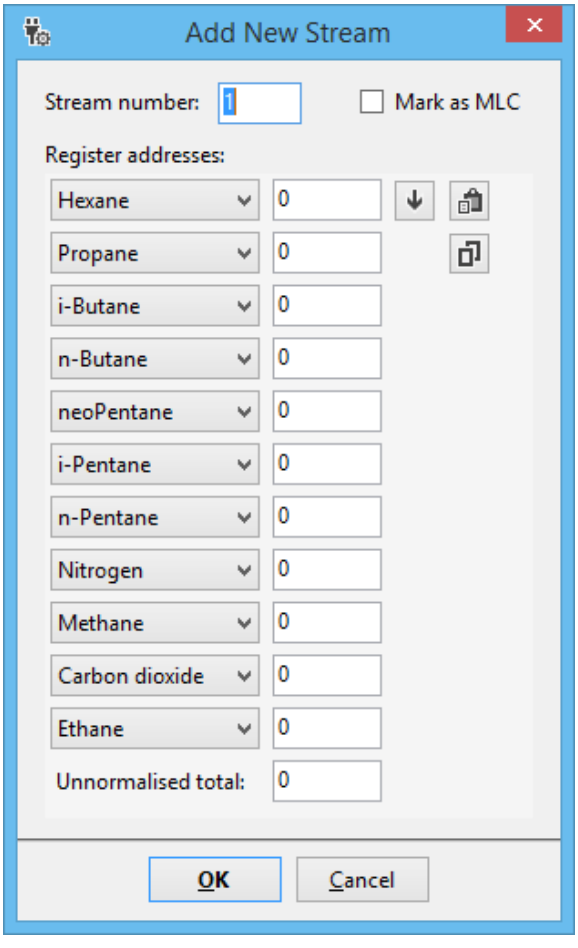
25.1.4 Mole Composition Streams

GCAS Desktop supports multiple streams of mole composition data, provided that each stream has its own unique set of register addresses and there are no address collisions between streams.

Note

You need the GCAS feature *Live Data Analysis* to be included in your licence in order to capture mole composition data.





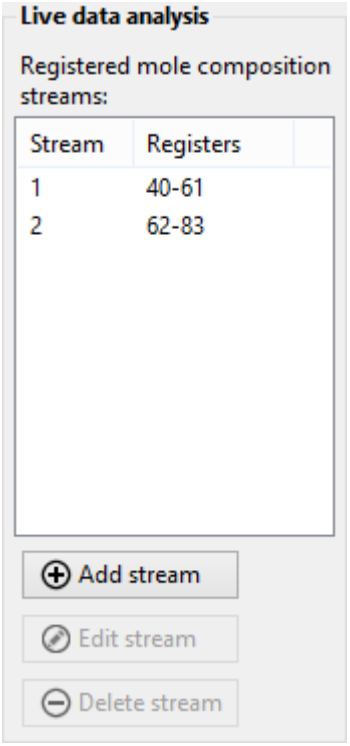
Click **Add stream** button to define a new stream. This brings forth another dialogue (see left) where you can define gas names and their register addresses. Also remember that each gas consumes two Modbus registers on 16-bit mode, but only one for each on 32-bit mode.

The last register address is reserved for unnormalised total. This is the sum of raw data read by GC device; for some devices may automatically normalise mole composition values so they add up to exact 100%.

Does your GC device not provide unnormalised total data? Visit chapter 25.1.5 for a workaround.

Users with GCAS feature *ISO 10723* in their licences shall see an additional check box near the top-right corner named **Mark as MLC**. This check box controls whether the incoming composition data on this stream should be marked as multilevel-calibrated or not. Rewind to chapter 8.10 to read more about multilevel-calibrated composition.

After you click **OK**, the new stream appears on the list. In this example, it displays `40-65` because we use standard 16-bit Modbus thus register `64` (unnormalised total) actually uses address `64` and `65`. Next register available for subsequent stream is `66`. If you use 32-bit Modbus, it will display `40-52` instead, because each component only uses one Modbus register.



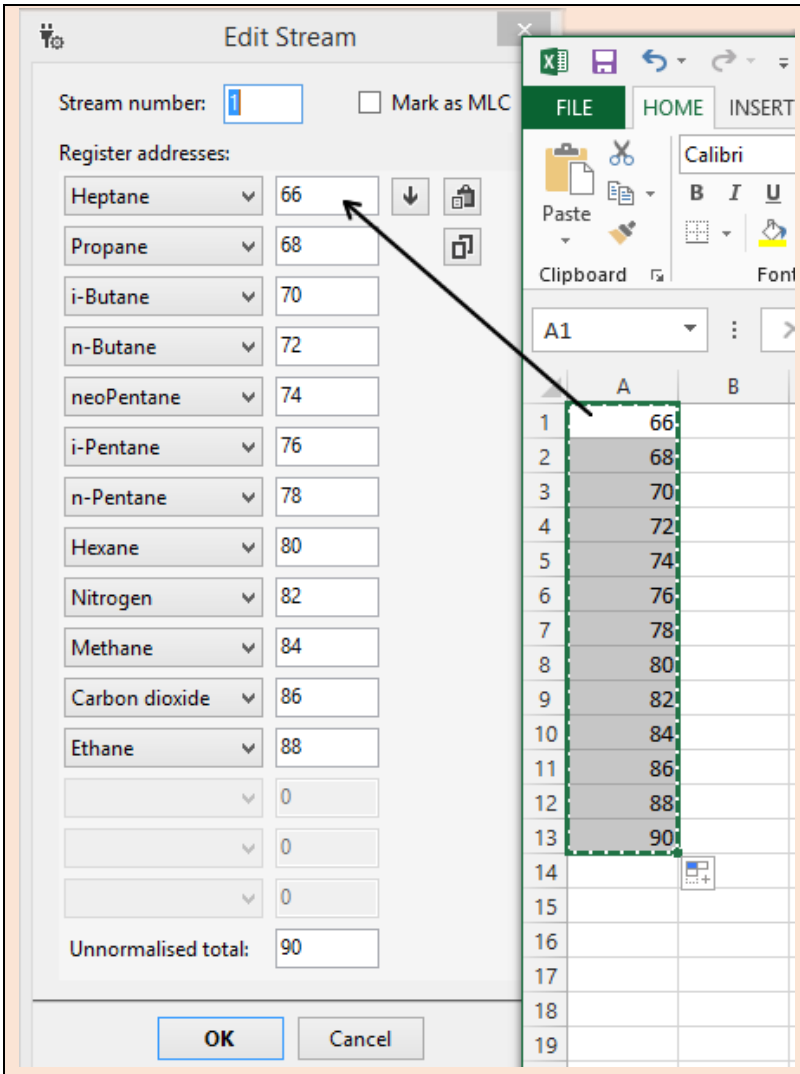
To edit a stream, click on the desired stream then click **Edit stream**. Likewise, to delete one, highlight the stream then the **Delete stream** button.

Tip

To quickly define sequential Modbus registers, enter the first register address then click **Flash fill**. For example, type `40` in heptane, click **Flash fill**, and GCAS Desktop shall assign `42` for propane, `44` for i-butane, `46` for n-butane, and so on. If you are on 32-bit Modbus then GCAS Desktop assigns `41` for propane, `42` for i-butane, `43` for n-butane, and so on.

However, if the register address for unnormalised total is not on sequential series as the other components. Do not forget to edit the register address for the unnormalised total after clicking Flash fill. We emphasise this because many Daniel GCs are configured like this.

You can also copy Modbus register addresses from Microsoft Excel or other spreadsheet processing software. Press `Ctrl+V` inside the **first text box** and the rest will follow, skipping the greyed out fields. Alternatively, click **Paste**.



The **Copy** button does the opposite—it copies register addresses from GCAS Desktop so you can paste it onto Microsoft Excel spreadsheet. The greyed out fields, if any, are also included in the copy operation.

25.1.5 What if my GC device cannot provide data for some gas?

Depending on the make, model, and configuration of your GC device, the device may not be able to provide some data. For example, a GC device does not provide data for unnormalised total of mole composition.

25.1.5.1 GC device does not provide retention time data

Simply untick **Read retention time** as described in chapter 25.1.3. The same applies if the GC device does not provide whole set of response factor data, you would untick **Read response factor**.

25.1.5.2 GC device does not provide response factor data, but it provides peak area

Unfortunately GCAS Desktop does not have the tool to calculate response factor from peak area and mole composition right on the GC Connect form. We suggest two workarounds:

1. Do not capture live data through GCAS Desktop, but obtain the data of peak area through other means (e.g. via the bundled software or report output). Later, go to Footprint form or Calibration Data form, open the Action menu and choose **Import Data - Manual Entry**. Select the third option ("*Response factor values are calculated from peak area*") and enter the data. Have the component data table or calibration gas certificate ready because you will also need to input the mole percentage values. Click **Save** and GCAS Desktop will calculate the response factor values. Unfortunately, this workaround is effective only for one single record. Inputting multiple records through manual entry is a tedious work and very error-prone.

2. Designate the RF register addresses for peak area and run the data capture as usual. But **never** send the incoming data directly to database, use the option Save to CSVs instead. After the data capture session ended, you can convert the peak area to RF values in the CSV file using your favourite spreadsheet editing software. Afterwards, import the CSV.

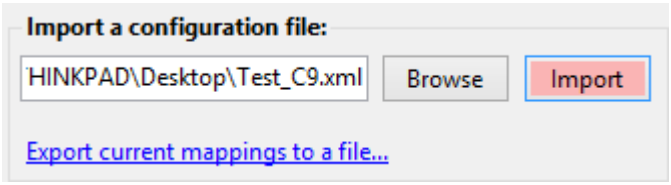
25.1.5.3 GC device does not provide unnormalised total for mole composition streams

Define a special register on your physical GC device and hard-code its value to **100** (or any scale you like, 100 is for percentage). Use two sequential registers if you are on 16-bit Modbus. On GCAS Desktop, set the register address for unnormalised total to the address of this special register. Repeat this step for every defined stream.

25.1.5.4 GC device does not provide RF or RT data of one or several particular gases

Define a special register on your physical GC device and hardwire its value to **−1** (negative one). Use two sequential registers if you are on 16-bit Modbus. On GCAS Desktop, set the register address of the offending component(s) to the address of this special register. By this way, GCAS Desktop will record the value −1, thus will not display the component on RF or RT chart. The chart will have gap(s) at the offending component(s).

25.1.6 Backup and Restore Configuration



To back up your configuration, click on the **Export current mappings to a file** link. This will show the save file dialogue to save the XML file.

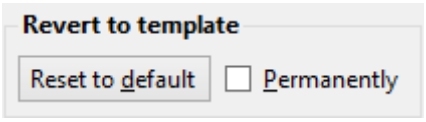
To restore your configuration, click **Browse** button and load that XML file. Next, click **Import** button and GCAS Desktop should read the content and display register addresses accordingly. Click **Save Mappings** at the bottom of the form to commit the change.

Note

Backup and restore facility is not intended for copying settings from one device to another because we cannot guarantee that the other device is the same type of the current device. You cannot use the XML file indended for one device on a different device. If you need to do this and you are sure that both devices are of the same type, a workaround is available in chapter 25.1.9 Troubleshooting.

25.1.7 Reset to Default

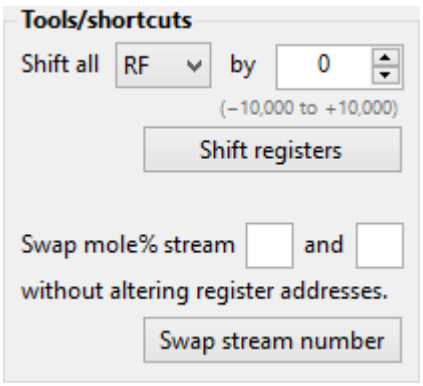
This section is only available if you have ever configured a device. For first-time configuration, this box does not appear.



Your register configuration is stored in an XML file in `[installation directory]\Mappings-DeviceSpecific\` directory. **Reset to default** button will revert all register addresses back to the default definition as defined in template file. When you click **Save Mappings** button at the bottom of the form, your XML file is overwritten.

If you first tick **Permanently** before clicking **Reset to default** button, not only GCAS Desktop restores all register addresses to the default definition as defined in template file, but also it deletes your XML file. Permanent reset will put your GC device in GCAS database into unconfigured state.

25.1.8 Tools/Shortcuts



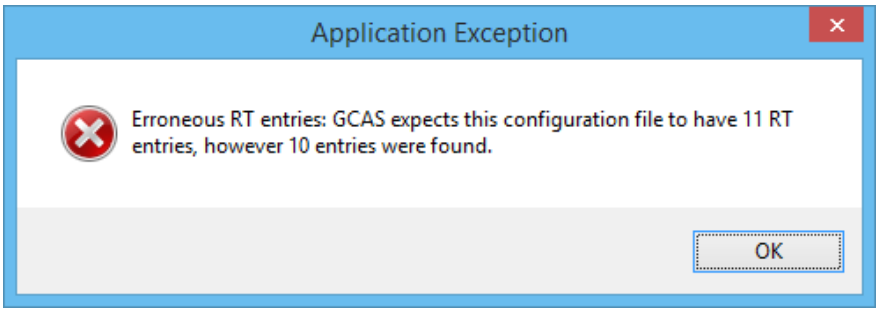
Instead of retyping all register addresses of RF and RT, use this section to shift registers addresses in one click. Choose which one to shift (RF or RT), enter the amount of address shift between −10,000 to +10,000, and then click **Shift registers**.

You can also swap mole composition stream numbers without changing their register addresses. Enter two existing stream numbers to switch place, then click **Swap stream number**.

25.1.9 Troubleshooting

a) **Q:** I see an error message "This file is not a valid configuration file".
A: There is a problem within the XML file. Open File explorer (Windows explorer), navigate to `[installation directory]\Mappings-DeviceSpecific\`. Default installation directory is `C:\GCAS`. Find the file of your device tag name.xml, then delete the file. This will reset the configuration of your device to follow template.

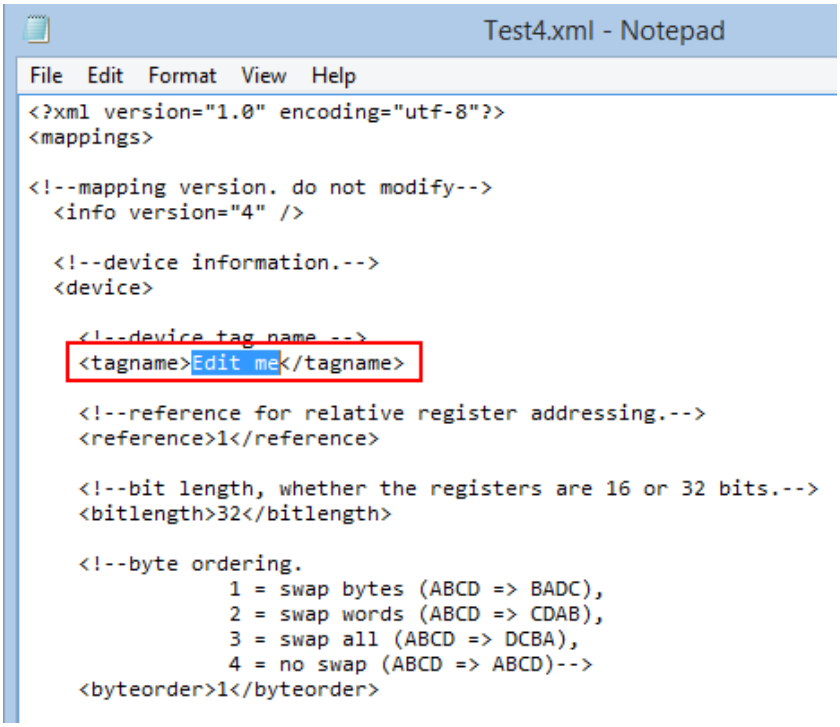
b) **Q:** I see an error message "Erroneous RF/RT entries" similar to this screenshot.


Application Exception
Erroneous RT entries: GCAS expects this configuration file to have 11 RT entries, however 10 entries were found.
OK

A: Again, there is a problem within the XML file. Open File explorer, navigate to `[installation directory]\Mappings-DeviceSpecific\`. Find the file of your device tag name.xml, then delete the file. This will reset the configuration of your device to follow template.

c) **Q:** I see an error message "Device type not supported".
A: GCAS Desktop cannot find the template file. Open File explorer, navigate to `[installation directory]\Mappings-Template\`. If the template file for your device type does not exist, either the device type is not yet supported by current version of GCAS Desktop or otherwise you might need to reinstall GCAS Desktop.

d) **Q:** When I import a configuration (XML) file, it says that the file belongs to other device.
A: The export configuration command link is not intended to copy settings among devices because we cannot guarantee that the other device is the same type as the device you are configuring. Their number of gases may differ. Therefore, we designed that the XML file belongs to a certain GC can only be used by that GC exclusively.
Nevertheless if you are very sure that both this GC device and the other device are of the same type, you would need to edit the XML file using Notepad or any text editor. Open the XML file, and find the `<devices>` element. It should be near the beginning of the file. Inside `<devices>`, find the `<tagname>` element. Change the device tag name between `<tagname>` and `</tagname>` to match the name of the device you are configuring. Save the file, and then try to import the XML file again.

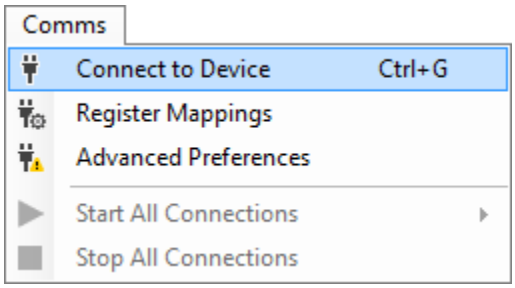


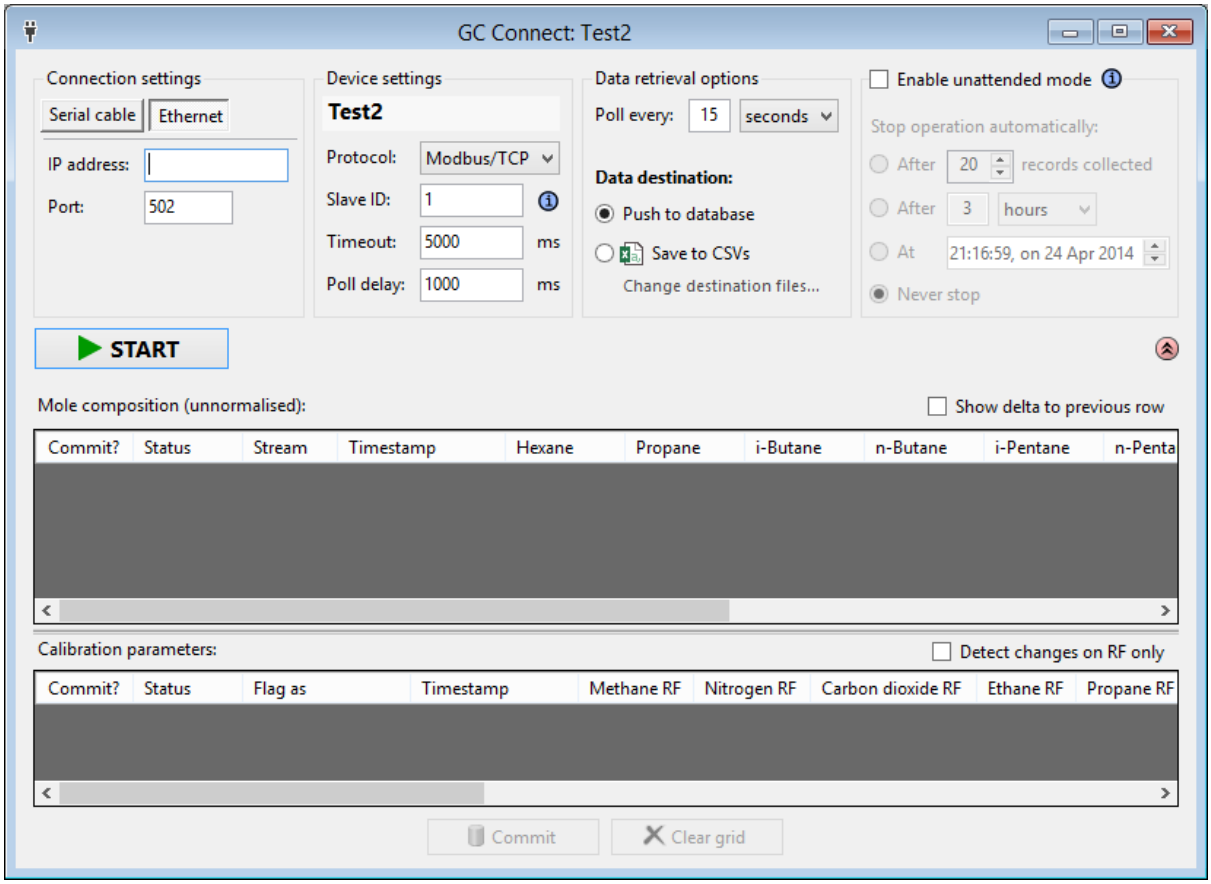
25.2 Capture Data

As the Modbus register configuration is ready, GCAS Desktop is ready to get some data from the GC device.

25.2.1 The *GC Connect* Form

Select the device you would like to get data for, then go to the Comms menu > **Connect to Device**.





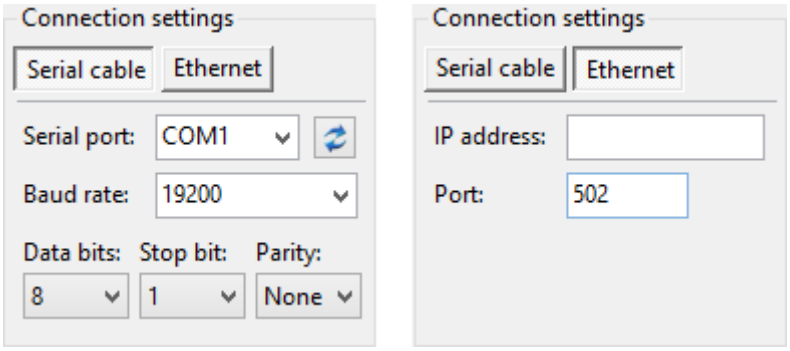
GC Connect form has two main parts, the options panel at the top and grid views at the bottom. Options panel consists of four parts, which are connection settings, device settings, data retrieval options, and unattended mode. If you see only three, resize the form so that it becomes larger to the right side. Unattended mode options may not be visible if your screen resolution is 1024×768.

There are two grids at the lower part of the form, one for calibration parameters and one for mole composition. If you only see the grid for calibration parameters, it means you do not have GCAS feature *Live Data Analysis* included in your licence.

To expand the grids and hide the options panel, click the **Expand** button. On the opposite, to restore the options panel you would click **Collapse** button.

25.2.2 Connection Settings

This section configures the connection medium between your computer and your GC device. GCAS Desktop supports two media, serial cable/RS-232 and Ethernet (or Wi-Fi, if your GC device supports it).



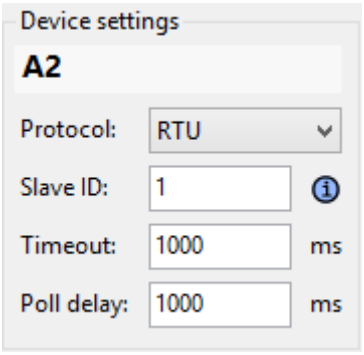
To use serial cable connection, you need a GCAS feature *Modbus over serial* to be included in your GCAS licence. Similarly to use Ethernet cable, you need a GCAS feature *Modbus over TCP*.

For serial cable connection, enter the appropriate COM port where the cable plugs to, followed by the baud rate, data bits, stop bit(s), and parity bit. These configuration should match the same configuration as your GC device (except the COM number).

For Ethernet or Wi-Fi connection, enter the IP address of your GC device and the TCP port. Refer to your GC device about the TCP port it listens. Modicon standard recommends 501, 502, or 1100 depending of the Modbus protocol set in the device settings.

25.2.3 Device Settings

This sections configures the Modbus protocol to communicate with GC device. Available Modbus protocol depends on the connection medium set in connection settings.



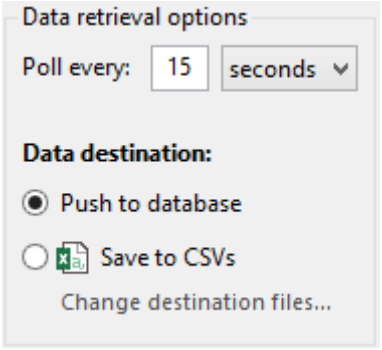
Connection medium	Available protocol
Serial cable	1. ASCII (plain text) 2. RTU (remote terminal unit)
Ethernet or Wi-Fi	1. Modbus/TCP 2. RTU over TCP

Slave ID is the Modbus device identifier that ranges from 1 to 255. In a typical one device to one computer configuration, usually the slave ID is 1 (one). Refer to the configuration on your GC device to get the slave ID.

Timeout is the period GCAS Desktop should wait after a Modbus command has been issued to the Device. Default value is 1000 milliseconds (one second) for serial cable and 5000 ms (5 seconds) for Ethernet or Wi-Fi. Note for RTU protocol (serial cable), this timeout starts counting *after the standard 3.5-second wait as specified in the RTU protocol specification itself*. Minimum value is 10 ms.

Poll delay is the period GCAS Desktop should wait after a timeout occurs before it retries to issue the same Modbus command to GC device. Default value is 1000 ms, but you can set it to zero if you don't want to wait.

25.2.4 Data Retrieval Options



You can set the poll interval at "**poll every**" input field starting from as frequent as every 5 seconds up to every 90 days. Typically, the poll interval is between 10 to 20 seconds. You can also match poll interval to the cycle time of your GC device, however please make sure time difference between the poll and the end of cycle is not too far apart.

Data destination: Choose where the captured data is being uploaded to.

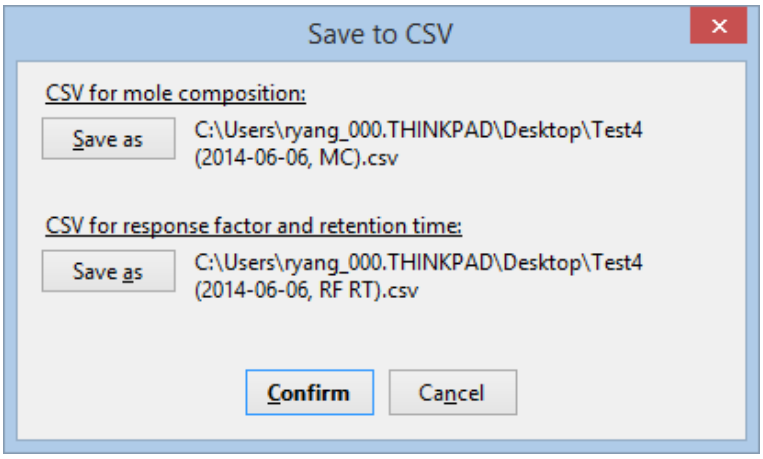
- **Push to database**: Data is uploaded to GCAS database.
- **Save to CSVs**: Data is saved as two CSV files.

For CSV option, GCAS Desktop creates two CSV files: One for RF and RT data, another for mole composition. If you do not have GCAS feature *Live Data Analysis* in your licence, the latter CSV is not created — GCAS writes only the RF and RT data into one CSV file.

The file for RF and RT data follows i-Vigilant CSV format so that it is usable for CSV import on Footprint or Calibration Data form. Similarly, CSV file for mole composition follows the format recognisable by CSV import on Mole Composition form.

Mole composition values are left unnormalised when GCAS Desktop writes to the CSV. When you import this CSV through the Mole Composition form, the values will be automatically normalised. If you choose to push to database however, GCAS Desktop always normalises all mole composition values before they are committed to database.

When you select **Save to CSVs** option, GCAS Desktop shows a dialogue. Here you set the CSV file names and their desired location. To change these later, click on the **Change destination files** link.

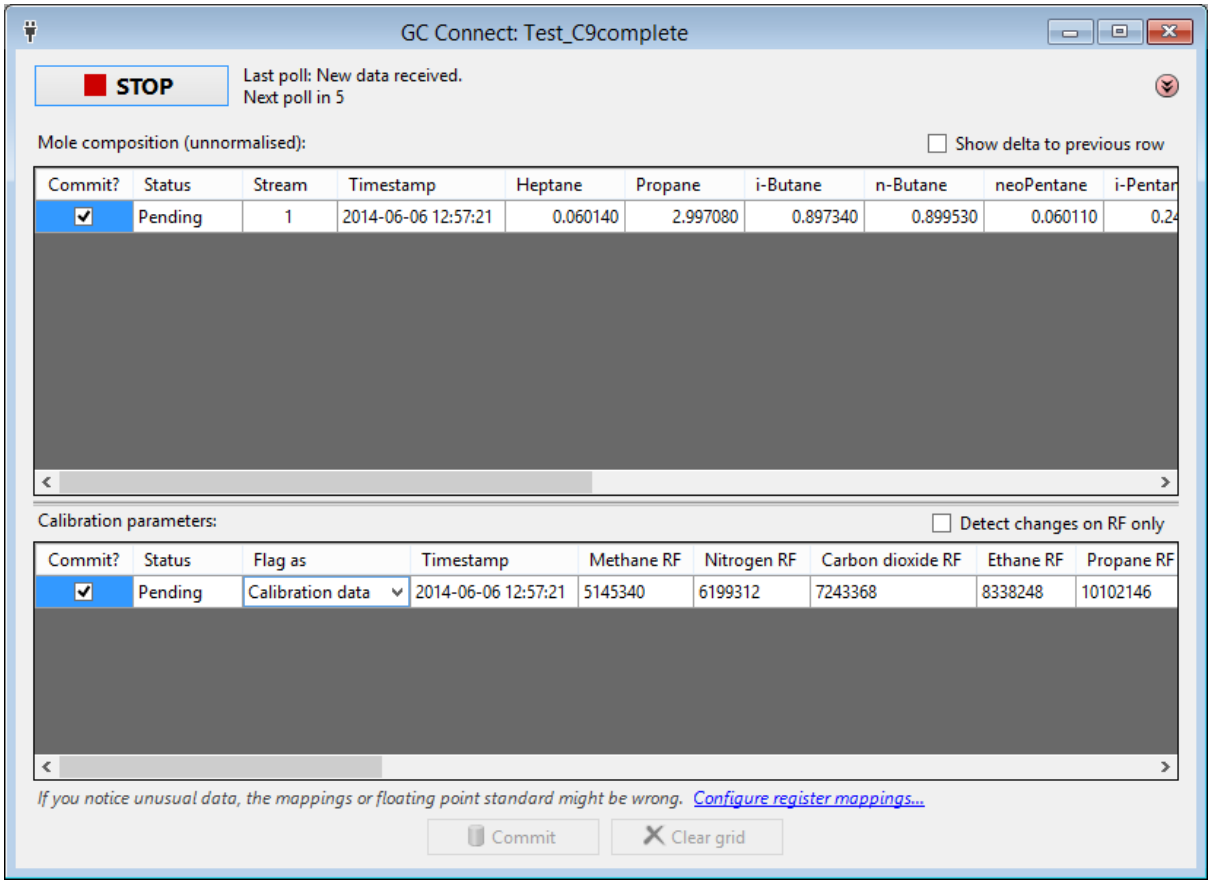


25.2.5 Start Capture

As the Modbus register mappings, connection settings, device settings, poll interval and data destination have been all configured, apparently now you are ready to get some data!

Hit the **Start** button to start the operation. GC Connect form will expand the grid view and poll the device for the first time after three seconds. After first poll, GC Connect form polls the device once every poll interval.

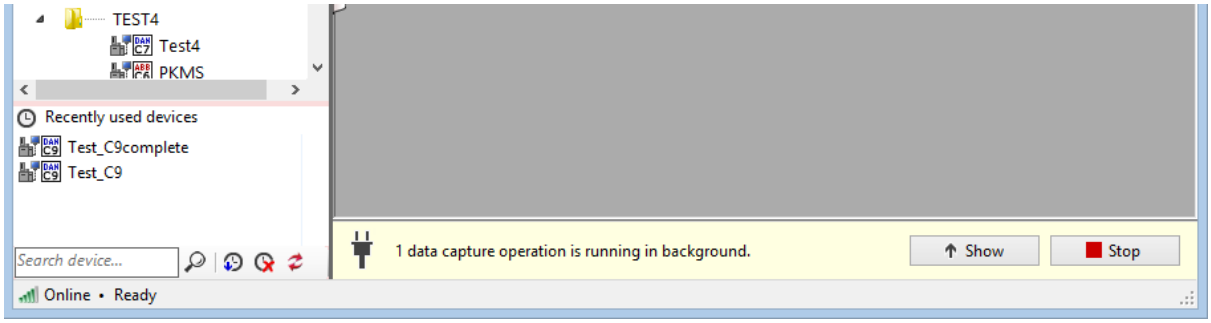
By default, response factor and retention time are given equal priority in calibration data. New incoming calibration data having same response factors as the previous row but with different retention time is still treated as new data. If you prioritise response factors over retention time, tick the check box **Detect changes on RF only**. By this way, incoming record having same RF but different RT from the previous one will not trigger a new row.


GC Connect: Test_C9complete
STOP
Last poll: New data received.
Next poll in 5
Mole composition (unnormalised):
Show delta to previous row
Commit? Status Stream Timestamp Heptane Propane i-Butane n-Butane neoPentane i-Pentar
Pending 1 2014-06-06 12:57:21 0.060140 2.997080 0.897340 0.899530 0.060110 0.24
Calibration parameters:
Detect changes on RF only
Commit? Status Flag as Timestamp Methane RF Nitrogen RF Carbon dioxide RF Ethane RF Propane RF
Pending Calibration data 2014-06-06 12:57:21 5145340 6199312 7243368 8338248 10102146
If you notice unusual data, the mappings or floating point standard might be wrong. Configure register mappings...
Commit
Clear grid

You can open multiple GC Connect forms and run multiple data capture sessions simultaneously, provided that no two GC Connect forms accessing the same device, through the same COM port or same IP address. GCAS Desktop suspends the idle timer if there is at least one active connection to GC device.

To stop capture, hit the **Stop** button.

If you accidentally closed the GC Connect form during an active data capture session, either by pressing `Ctrl+F4` or the close (×) button on its tile bar, the form is still running in background. The main interface displays a panel notification at the bottom region, thus you can bring the GC Connect form back into view or stop its capture operation instead. *Nevertheless, if you deliberately log out while a data capture is running in background, the form will be stopped, closed, and its pending records are discarded.*



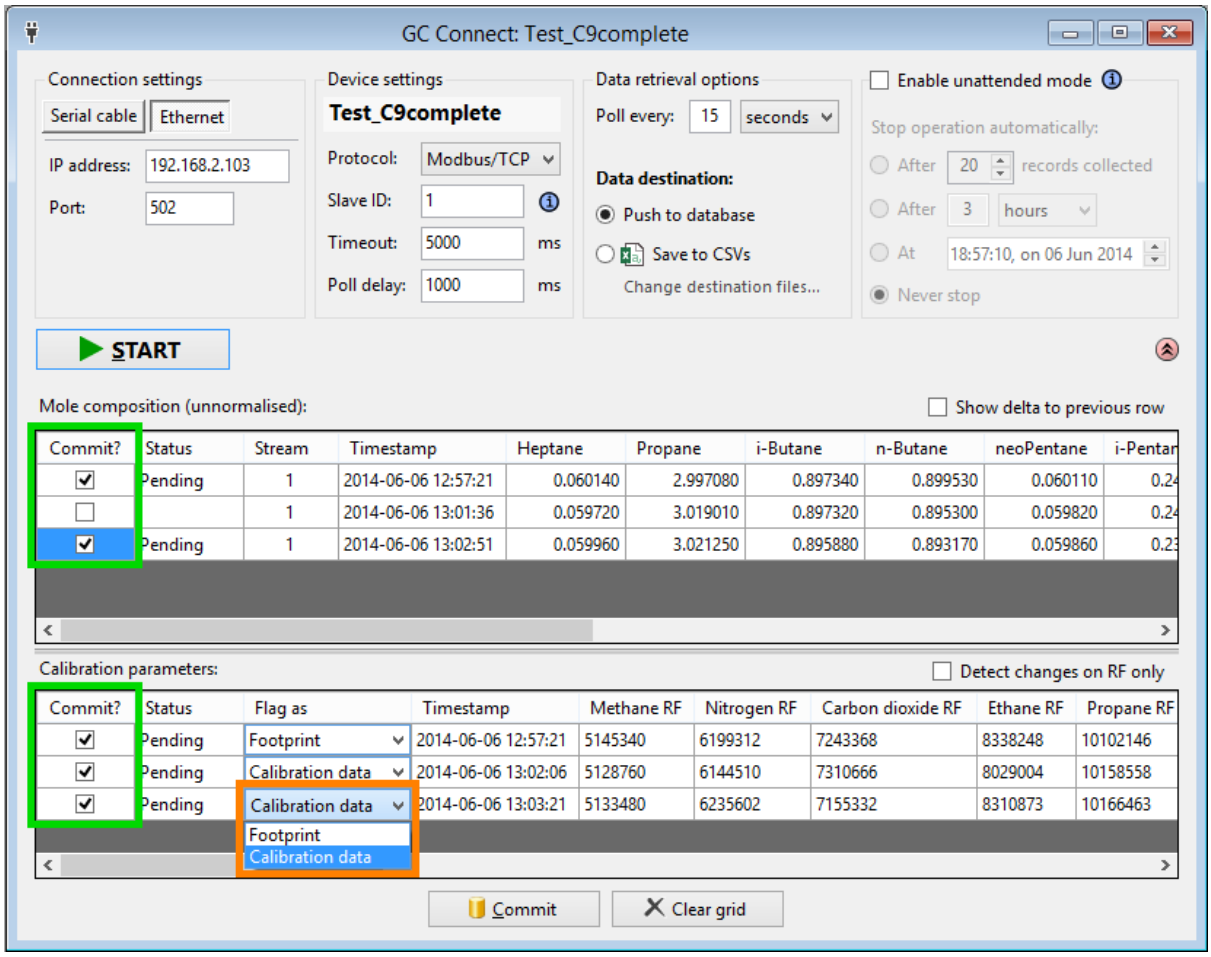
When multiple data capture operations are running in background, these two buttons become **Show all** and **Stop all**.

25.2.6 Stop Capture and Commit Data

Click the **Stop** button to stop the operation.

Note

If you click **Stop** button when GCAS Desktop is in the middle of polling GC device, GCAS Desktop waits two seconds in order to allow the poll to finish before terminating the connection. If the poll takes very long (e.g. on an extremely slow network or over VPN connection), GCAS Desktop waits for additional two seconds, up to five times (10 seconds) maximum.


GC Connect: Test_C9complete
Connection settings
Serial cable
Ethernet
IP address: 192.168.2.103
Port: 502
Device settings
Test_C9complete
Protocol: Modbus/TCP
Slave ID: 1
Timeout: 5000 ms
Poll delay: 1000 ms
Data retrieval options
Poll every: 15 seconds
Data destination:
Push to database
Save to CSVs
Change destination files...
Enable unattended mode
Stop operation automatically:
After 20 records collected
After 3 hours
At 18:57:10, on 06 Jun 2014
Never stop
START
Mole composition (unnormalised):
Show delta to previous row
Commit? Status Stream Timestamp Heptane Propane i-Butane n-Butane neoPentane i-Pentar
Pending 1 2014-06-06 12:57:21 0.060140 2.997080 0.897340 0.899530 0.060110
1 2014-06-06 13:01:36 0.059720 3.019010 0.897320 0.895300 0.059820
Pending 1 2014-06-06 13:02:51 0.059960 3.021250 0.895880 0.893170 0.059860
Calibration parameters:
Detect changes on RF only
Commit? Status Flag as Timestamp Methane RF Nitrogen RF Carbon dioxide RF Ethane RF Propane RF
Pending Footprint 2014-06-06 12:57:21 5145340 6199312 7243368 8338248 10102146
Pending Calibration data 2014-06-06 13:02:06 5128760 6144510 7310666 8029004 10158558
Pending Calibration data 2014-06-06 13:03:21 5133480 6235602 7155332 8310873 10166463
Footprint
Calibration data
Commit
Clear grid

Untick records to *ignore* them, see green rectangle on the screenshot above. Ignored records will not be written to database or CSV files. For calibration parameters, you can change its flag in the "**Flag as**" column whether to mark a record as a footprint or a regular calibration data. (See orange rectangle on the screenshot above.)

To commit (write) the data into database or CSV files, click either **Commit** button or **Save to CSVs** button. Otherwise, **Clear grid** button removes all *committed, pending*, *ignored*, and *failed* rows from display. Alternatively, click the **Start** button again to resume capturing data.

The **Status** column may display any of the following:

- No text/blank: The record is ignored and will not be committed to database nor CSV files.
- **Pending** (black): The record is awaiting commit or save operation.
- **Committed** (green): The record has been successfully written to database or CSV files. Click Clear grid button to clear all committed rows from both grid views.
- **Failed** (red): The record could not be written to database or CSV files.
  Usually the **Error log** button appears on the bottom-left corner of the form and you click that button to see why the record failed to commit. Otherwise, open the Action menu and select **View Error Log**.
  (Note if you are in unattended mode, first click **Collapse** button then deactivate unattended mode to see Error log button).

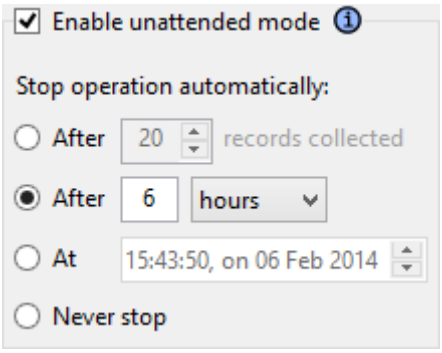
25.2.7 Unattended Mode

Unattended data capture is a data capture operation where all incoming data are committed to database or CSV files automatically. It is intended for remote sites where engineers rarely present in-situ while GCAS Desktop continuously captures data. You can then leave the computer on and come back later to stop the operation.

The regular way to capture data as described in chapter 25.2.5 Start Capture and 25.2.6 Stop Capture is known as *attended mode*. The table below summarises difference between attended and unattended mode.

Attended mode	**Unattended mode**
Incoming records await your decision whether to commit or ignore.	Incoming records are committed immediately.
You need to click **Commit** button or **Save to CSVs** button in order to commit the records.	**Commit** button, **Save to CSVs** button, and **Clear grid** button are not available in unattended mode.
You can review RF and RT records, giving you a time to change their flag either to footprint or calibration data.	**All records are automatically marked as calibration data.**
Click the **Stop** button to stop operation.	Click the **Stop** button to stop operation, or choose one of three available automatic stop triggers.

To activate unattended mode, first tick the check box **Enable unattended mode**.



Notice that the **Commit** button/**Save to CSVs** button and **Clear grid** button disappear from the bottom of the form. We don't need these buttons as the records would be committed automatically.

Choose one of the following automatic stop triggers.

1. **After *x* records collected** (default *x* = 20)
   GCAS Desktop stops the data capture operation after *x* new records have been collected. Operation stops whichever record type reaches *x* first, whether calibration parameter records or mole composition records.

2. **After *x* period of time**
   GCAS Desktop stops the data capture operation after *x* period of time, whether it is *x* seconds, *x* minutes, *x* hours, or *x* days. You can choose from as short as 15 seconds to as long as 90 days.

   Note

   To prevent GCAS Desktop consumes too much memory (RAM), GCAS Desktop only display the last 25 committed records. Old committed records are removed from the grid view. (They are not deleted from database or CSV files, though.) Failed records are never removed from view.

3. **At specific time**
   GCAS Desktop stops the data capture operation at the defined time.

   Note

   To prevent GCAS Desktop consumes too much memory (RAM), GCAS Desktop only display the last 25 committed records. Old committed records are removed from the grid view. (They are not deleted from database or CSV files, though.) Failed records are never removed from view.

4. **Never stop**
   GCAS Desktop does not stop data capture operation. Someone must come back to the computer later and stop the operation manually through the ■ Stop button.

   Note

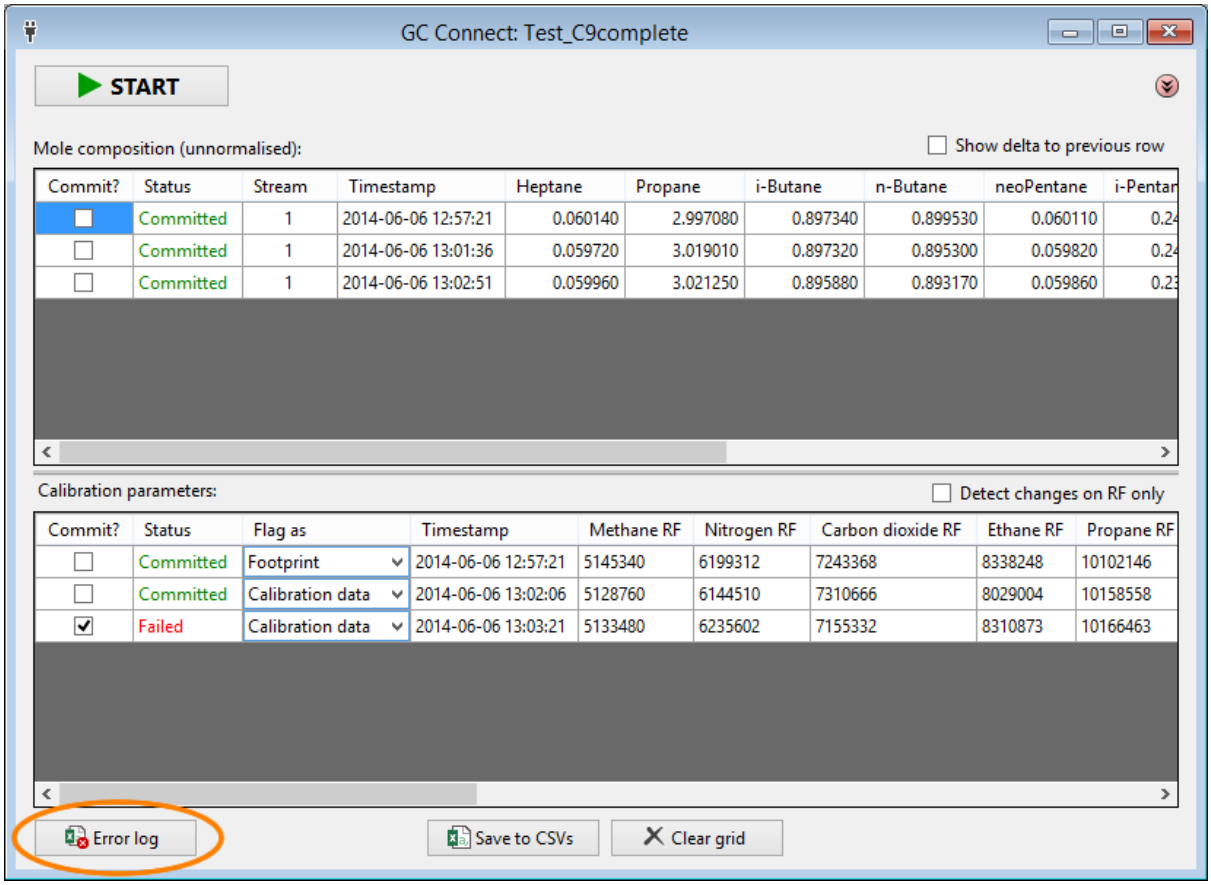
> To prevent GCAS Desktop consumes too much memory (RAM), GCAS Desktop only display the last 25 committed records. Old committed records are removed from the grid view. (They are not deleted from database or CSV files, though.) Failed records are never removed from view.

And finally, hit the **Start** button to start capturing data in unattended mode.

To deactivate unattended mode, stop the data capture operation and untick the check box **Enable unattended mode**.

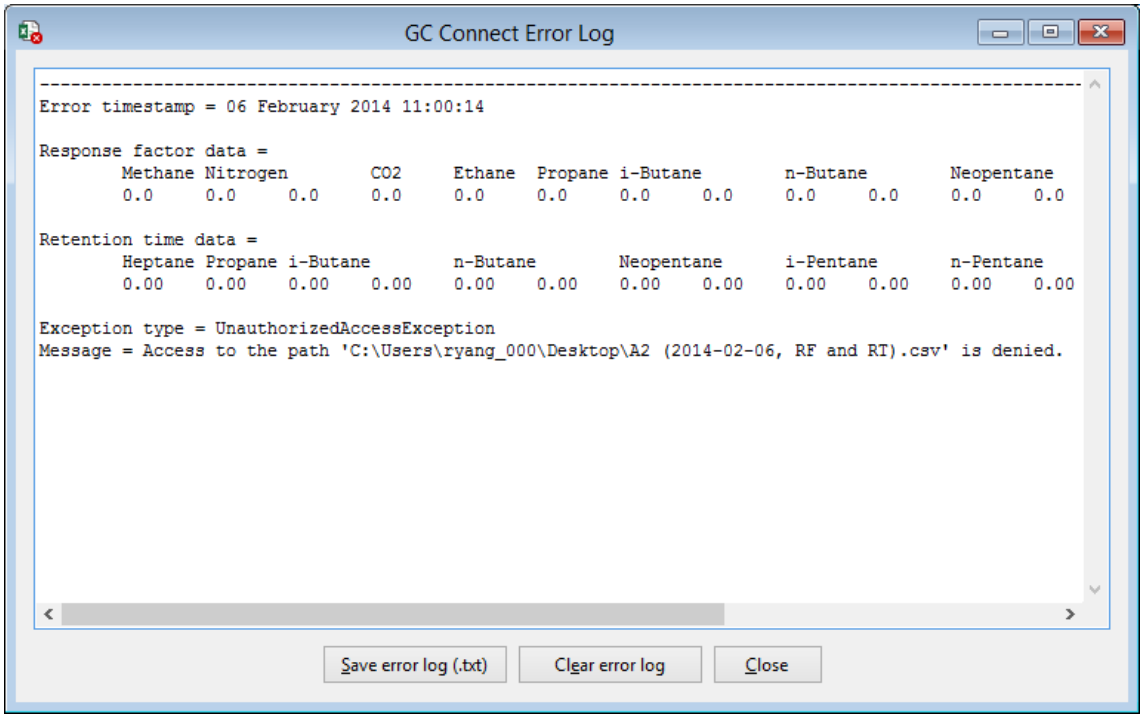
25.2.8 Data Capture Error Log

In case of records failing to commit, the **Error log** button usually appears at the bottom-left corner of the form.


GC Connect: Test_C9complete
START
Mole composition (unnormalised):
Show delta to previous row
Commit? Status Stream Timestamp Heptane Propane i-Butane n-Butane neoPentane i-Pentar
Committed 1 2014-06-06 12:57:21 0.060140 2.997080 0.897340 0.899530 0.060110 0.24
Committed 1 2014-06-06 13:01:36 0.059720 3.019010 0.897320 0.895300 0.059820 0.24
Committed 1 2014-06-06 13:02:51 0.059960 3.021250 0.895880 0.893170 0.059860 0.23
Calibration parameters:
Detect changes on RF only
Commit? Status Flag as Timestamp Methane RF Nitrogen RF Carbon dioxide RF Ethane RF Propane RF
Committed Footprint 2014-06-06 12:57:21 5145340 6199312 7243368 8338248 10102146
Committed Calibration data 2014-06-06 13:02:06 5128760 6144510 7310666 8029004 10158558
Failed Calibration data 2014-06-06 13:03:21 5133480 6235602 7155332 8310873 10166463
Error log
Save to CSVs
Clear grid

If you are on unattended mode, first stop data capture operation, show the options panel via **Collapse** button and then deactivate the unattended mode to see this button. Alternatively, simply open Action menu and select **View Error Log**.

Error log shows you the error messages why the record could not commit on every occasion of failed record. In this example, `Unauthorised access exception` means either the CSV file was marked as read-only, or your Windows user account do not have write permission on the folder where the CSV file resides.

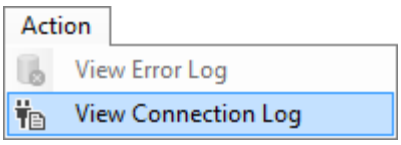

GC Connect Error Log
Error timestamp = 06 February 2014 11:00:14
Response factor data =
Methane Nitrogen CO2 Ethane Propane i-Butane n-Butane Neopentane
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Retention time data =
Heptane Propane i-Butane n-Butane Neopentane i-Pentane n-Pentane
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
Exception type = UnauthorizedAccessException
Message = Access to the path 'C:\Users\ryang_000\Desktop\A2 (2014-02-06, RF and RT).csv' is denied.
Save error log (.txt)
Clear error log
Close

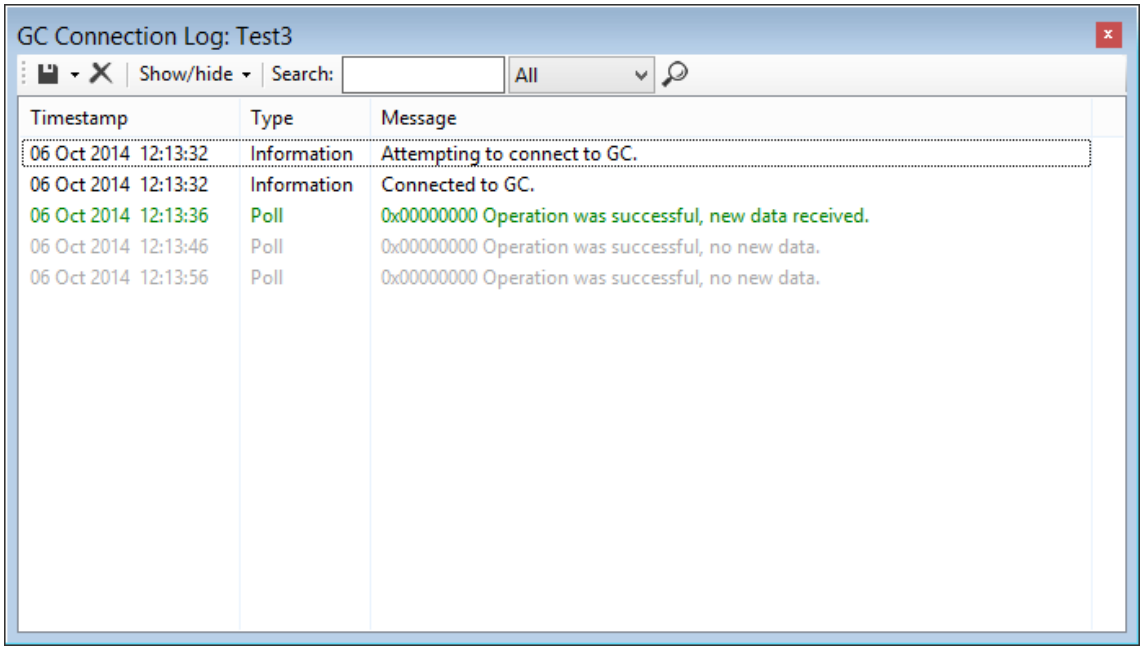
25.2.9 Data Capture Connection Log

The *connection log* records several types of event during data capture operation. For example, when the connection is started, connection is stopped, poll results, whether the record successfully committed (unattended mode only), and error codes.

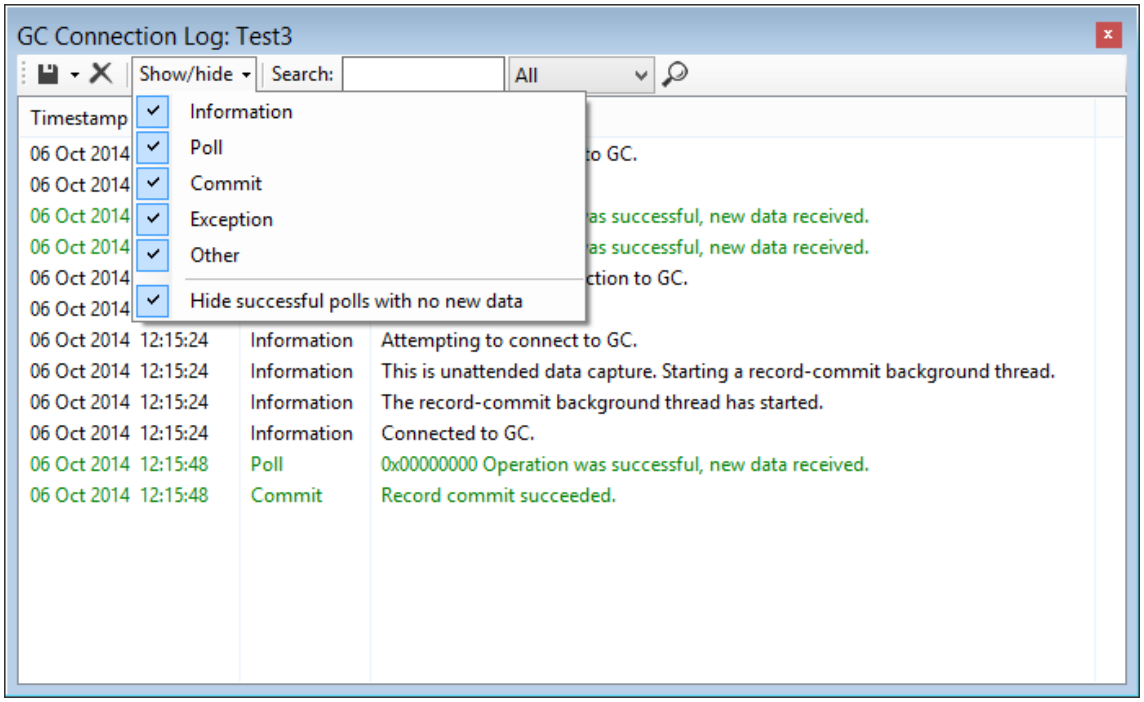
One device has one connection log and error log. If you run multiple data capture operations simultaneously, each GC Connect form has its own error log and connection log. Both logs are cleared when you close the GC Connect form.

To view the connection log, open the Action menu and select **View Connection Log**.

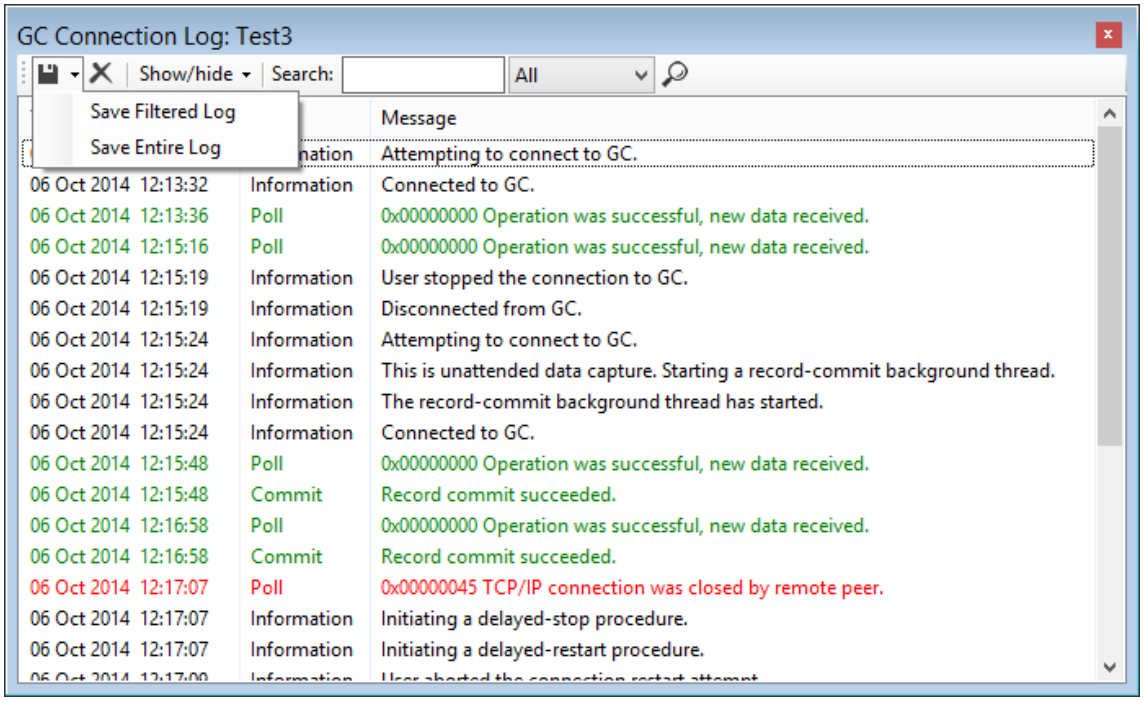



GC Connection Log: Test3
Show/hide
Search:
All
Timestamp
Type
Message
06 Oct 2014 12:13:32 Information Attempting to connect to GC.
06 Oct 2014 12:13:32 Information Connected to GC.
06 Oct 2014 12:13:36 Poll 0x00000000 Operation was successful, new data received.
06 Oct 2014 12:13:46 Poll 0x00000000 Operation was successful, no new data.
06 Oct 2014 12:13:56 Poll 0x00000000 Operation was successful, no new data.

Click **Show/hide** to filter which types of event to display on the connection log window. Clicking a dropdown menu will toggle that filter to on or off. If you tick **Hide successful polls with no new data**, all polling events having 0x00000000 error code (which indicates "no error" or a successful poll) without new data will be hidden.

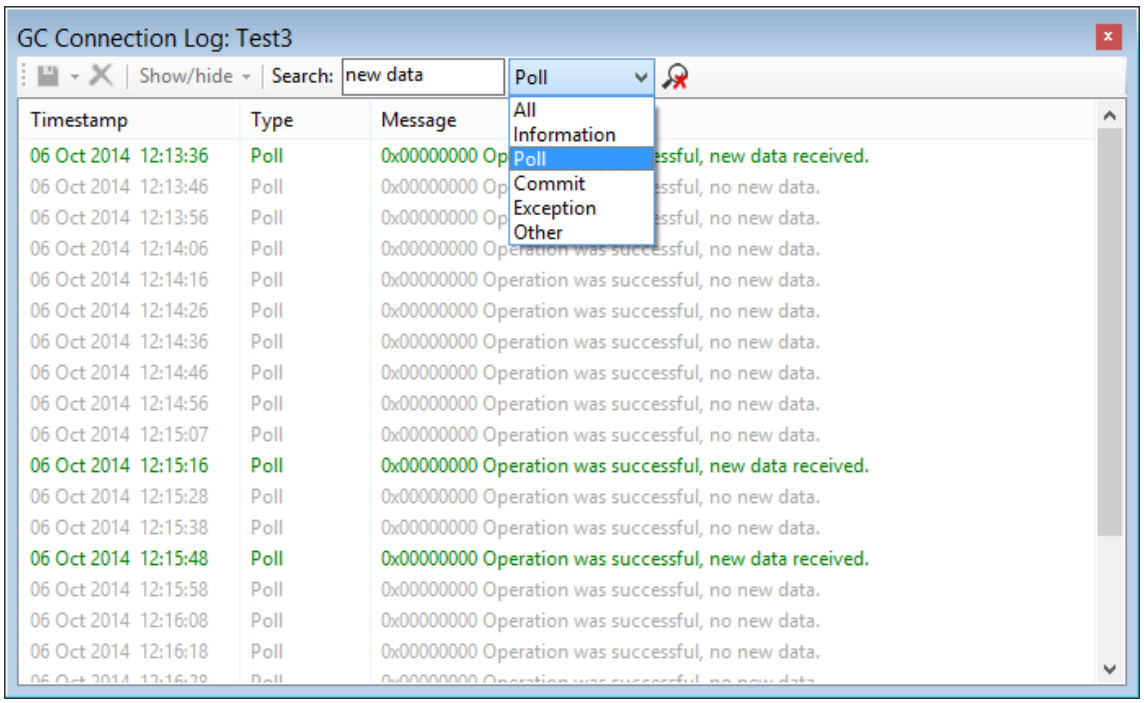

GC Connection Log: Test3
Show/hide
Search:
All
Information
Poll
Commit
Exception
Other
Hide successful polls with no new data
06 Oct 2014 12:15:24 Information Attempting to connect to GC.
06 Oct 2014 12:15:24 Information This is unattended data capture. Starting a record-commit background thread.
06 Oct 2014 12:15:24 Information The record-commit background thread has started.
06 Oct 2014 12:15:24 Information Connected to GC.
06 Oct 2014 12:15:48 Poll 0x00000000 Operation was successful, new data received.
06 Oct 2014 12:15:48 Commit Record commit succeeded.

To save the error log, click **Save**. Connection log is saved in a CSV format. However, this button will save the *filtered log*, as only displayed items are saved. To save the *entire log* inclucing those hidden items, open the small drop down menu near the Save button and select **Save Entire Log**.


GC Connection Log: Test3
Show/hide
Search:
All
Save Filtered Log
Save Entire Log
Message
Attempting to connect to GC.
06 Oct 2014 12:13:32 Information Connected to GC.
06 Oct 2014 12:13:36 Poll 0x00000000 Operation was successful, new data received.
06 Oct 2014 12:15:16 Poll 0x00000000 Operation was successful, new data received.
06 Oct 2014 12:15:19 Information User stopped the connection to GC.
06 Oct 2014 12:15:19 Information Disconnected from GC.
06 Oct 2014 12:15:24 Information Attempting to connect to GC.
06 Oct 2014 12:15:24 Information This is unattended data capture. Starting a record-commit background thread.
06 Oct 2014 12:15:24 Information The record-commit background thread has started.
06 Oct 2014 12:15:24 Information Connected to GC.
06 Oct 2014 12:15:48 Poll 0x00000000 Operation was successful, new data received.
06 Oct 2014 12:15:48 Commit Record commit succeeded.
06 Oct 2014 12:16:58 Poll 0x00000000 Operation was successful, new data received.
06 Oct 2014 12:16:58 Commit Record commit succeeded.
06 Oct 2014 12:17:07 Poll 0x00000045 TCP/IP connection was closed by remote peer.
06 Oct 2014 12:17:07 Information Initiating a delayed-stop procedure.
06 Oct 2014 12:17:07 Information Initiating a delayed-restart procedure.

In order to preserve computer memory, the connection log only retains the last 40,000 log items. When the connection log has reached 40,000 items, the oldest log items are discarded one by one. Click **Clear log** to empty the entire connection log immediately.

Type the search word in the search box and hit **Search** to find the word in the connection log. Before clicking **Search**, you can change the search filter dropdown to limit the searching area. Notice that searching a term in connection log will search the entire log, not only the filtered log. Click **Finish searching** to end the search mode.



25.3 Modbus Error Codes and Handling

Bad things happen during data capture. Source of problems might be bad cables, aging hubs, overloaded router, Wi-Fi interference, and so forth. When GCAS Desktop does not get a proper response from the GC device, it raises an error code.

We make a distinction between *error codes* and *exceptions*. **Error code** indicates an error in the Modbus protocol communication. The cause may be the computer, the GC device, or the medium between computer and GC device. **Exception**, by definition in technical term, is an error caused by problems inside GCAS Desktop itself and not your GC device. Both error codes and exceptions are logged in the connection log.

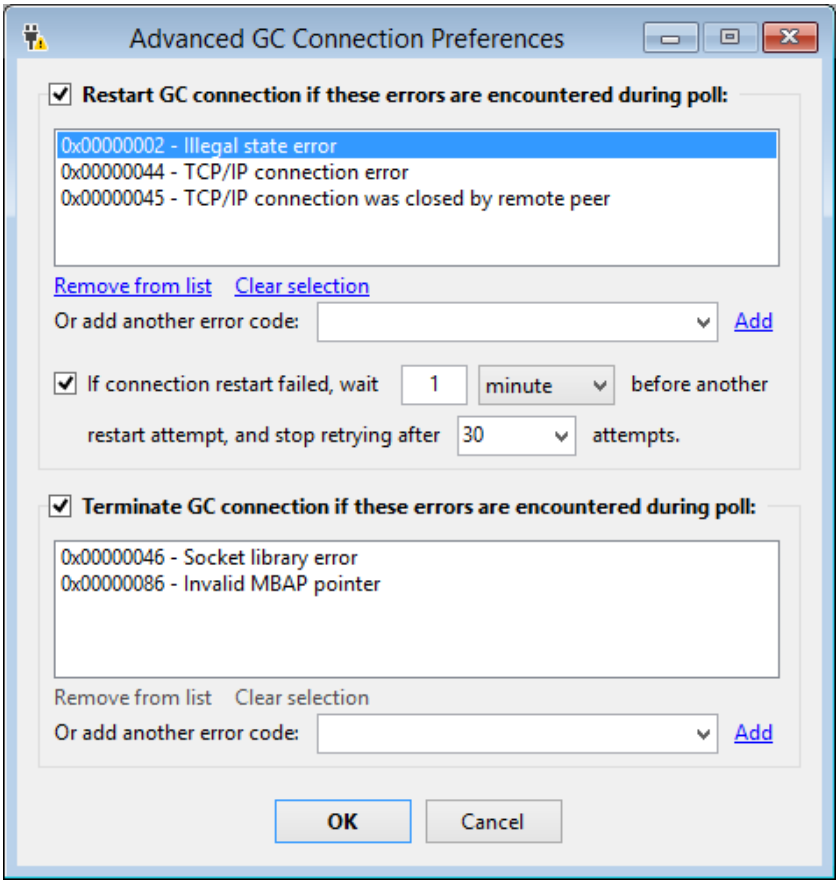
25.3.1 About Error Codes

If there was error in Modbus protocol communication during data capture, the GC Connect form will display the error code above the countdown. For example, the most common error is **0x00000044 TCP/IP connection error**. This error happens only in TCP connection — not in serial cable connection — and indicates problem such as congestion, corrupted TCP packet, wrong TCP checksum, or Wi-Fi connection between your computer and GC (if your GC supports Wi-Fi) is experiencing problems. Another common error code is **0x00000045 TCP/IP connection was closed by remote peer**. This error code indicates problems like the Ethernet cable is unplugged or the main power to GC was cut.

Some error codes are temporary, such as **0x00000084 Reply time out**. By *temporary* it means the error may vanish by the next poll. However some error codes are *persistent*, which means the error code will be repeated during next poll and next poll and next poll until you stop the connection. This is particularly bad for unattended mode. In order to avoid that, GCAS Desktop introduced automatic connection restart and automatic connection termination. This feature is turned on by default, and you will go to the Advanced GC Connection Preferences dialogue in order to configure which error codes trigger the automatic restart or termination.

25.3.2 Advanced GC Connection Preferences

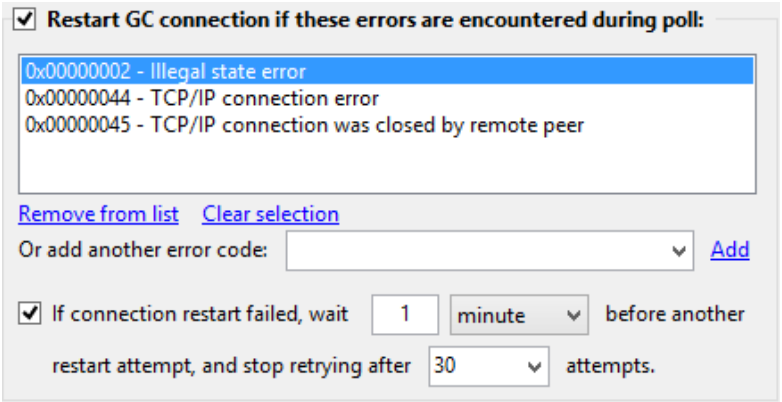
Go to the Comms menu > **Advanced Preferences**. This menu brings the *Advanced GC Connection Preferences* dialogue.



This dialoge configures the automatic connection restart and automatic connection termination. To get help on automatic connection restart, go to chapter 25.3.3. To read more about automatic connection termination, head to chapter 25.3.4.

25.3.3 Automatic Connection Restart

Automatic connection restart is a feature to stop GC connection temporarily and restart it immediately or with delay when GCAS Desktop encounters certain error codes. To turn on this feature, give a check mark on **Restart GC connection if these errors are encountered during poll**. This feature is already turned on by default for error codes 0x00000002 *Illegal state error*, 0x00000044 *TCP/IP connection error*, and 0x00000045 *TCP/IP connection was closed by remote peer*. When GCAS Desktop encounters any of these three error codes, it will trigger a connection restart.



To remove an error code from the trigger list, highlight the error code and click **Remove from list**. The next link **Clear selection** deselects any selected items.

To add an error code to this trigger list, choose one from the dropdown or type the error code in hexadecimal number (for example `0x00000084`) then click **Add**.

When GCAS Desktop restarts a connection, it stops the connection and restarts it immediately. However, there are chances that the first restart will still fail. If you want GCAS Desktop to keep retrying, give a tick mark on **If connection restart failed, wait *x* minute(s)** and set how much the delay GCAS Desktop should wait before another attempt of reconnection. During this wait time, you can abort the process by clicking **Stop** button on GC Connect form and the restart attempt will be cancelled. If this is not ticked, the GC Connect form will stay stopped after first restart attempt failed.

Set how many retries GCAS Desktop should try. The default is 30 attempts, which means GCAS Desktop will give up after 30 times of unsuccessful reconnection. Pick one from the drop down or type a number. Choose **infinite** to make GCAS Desktop keeps retrying forever.

Note

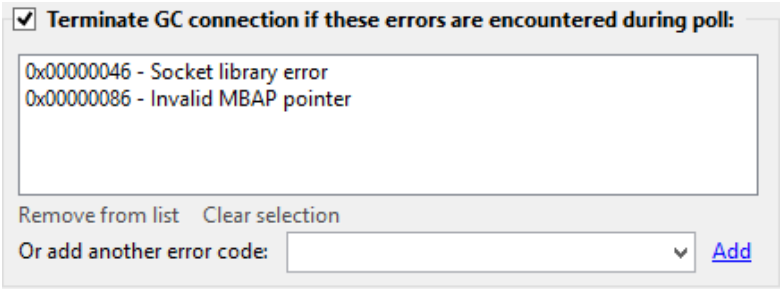
Automatic restart only works for the enlisted error codes during *poll*. It will not work if you get the error code *at the start of connection*.

For example, if you get 0x00000044 TCP/IP connection error *when you click* **Start** *button*, it means the IP address of your GC is wrong or the destination IP address does not listen to port 502 (or the defined port). Restarting GC connection for wrong IP address is useless, therefore GCAS Desktop will not attempt to reconnect to your GC.

It's a different story if you get 0x00000044 *at a regular poll*, it means there is network problem between your computer and your GC. This error code can be solved by restarting TCP connection.

25.3.4 Automatic Connection Termination

Automatic connection termination is a feature to stop GC connection permanently when GCAS Desktop encounters certain error codes. Typically the error codes in the auto-terminate list represent fatal errors. To turn on this feature, give a check mark on **Terminate GC connection if these errors are encountered during poll**. This feature is already turned on by default for error codes 0x00000046 *Socket library error* and 0x00000086 *Invalid MBAP pointer*. When GCAS Desktop encounters any of these two error codes, it will stop GC connection.


Terminate GC connection if these errors are encountered during poll:
0x00000046 - Socket library error
0x00000086 - Invalid MBAP pointer
Remove from list
Clear selection
Or add another error code:
Add

The error code 0x00000046 *Socket library error* indicates a problem within Microsoft Windows Socket (winsock). The way to fix this error is you need to open an elevated command prompt (run as administrator), enter this command:

```
netsh int ip reset
```

and restart the computer. It is not something GCAS Desktop can fix with a simple reconnection.

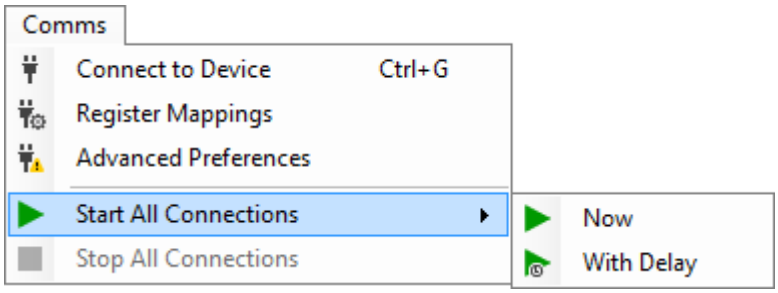
The error code 0x00000086 *Invalid MBAP pointer* may happen to a very limited number of GC devices (usually GC with old firmwares) on ethernet connection. It has something to do with the way GC respond back to the command issued by the computer.

Simply explained, MBAP stands for Modbus Application Protocol. When a computer issues a Modbus command to a machine (the GC), there is a "transaction ID", a number at the beginning of every data packet travelling along the network. When your GC device finished executing the command and ready to send back a response, it *must* echo the same transaction ID at the beginning of response. This is how Modbus protocol works as already defined in the Modbus protocol standard. However, some GC devices do not follow this standard. Instead of echoing back the transaction ID, they set the transaction ID to zero. Because GCAS Desktop follows Modbus standard, GCAS Desktop rejects this response and issues 0x00000086 error code. To fix this problem you might have to upgrade the firmware of GC device. Restarting GC connection won't help, therefore it is better for GCAS Desktop to terminate connection.

Similar to automatic restart configuration, highlight an error code and click **Remove from list** to remove the error code from auto-terminate trigger list. To add an error code, select one from the dropdown list or type the error code in hexadecimal number and then click **Add**.

25.4 Controlling Multiple Data Captures

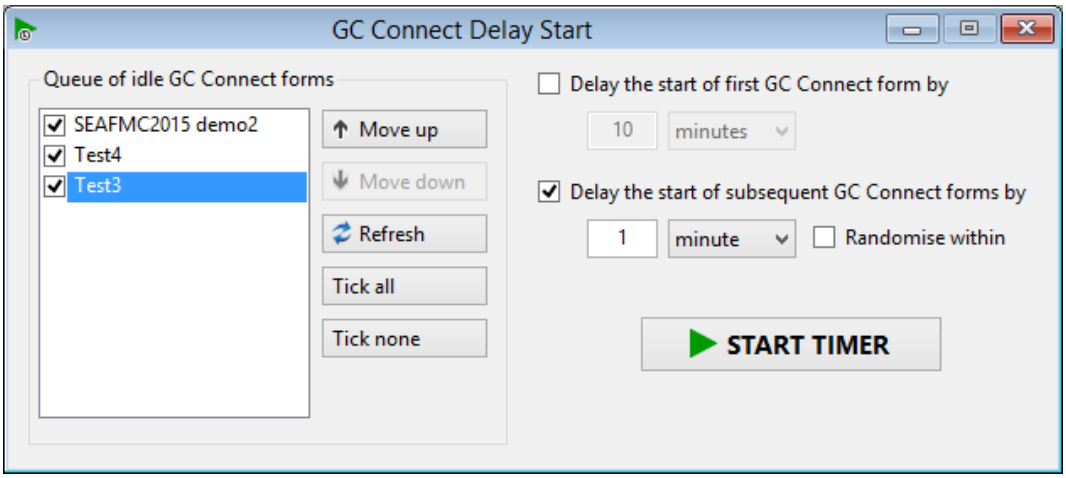
The Comms menu on the main user interface provides two shortcuts to control multiple data capture operations.



Start All Connections menu is a way to start multiple data captures simultaneously or with delay. **Stop All Connections** menu will attempt to stop all data capture operations and abort any GC Connect form in reconnecting state. If there are some GC Connect forms being hidden, the Comms menu displays another menu called **Reveal Hidden GC Connect Forms** which pretty straightforwardly will unhide all hidden GC Connect forms.

25.4.1 Start Multiple Data Captures with Delay

This menu is accessible if you open multiple GC Connect forms *but haven't started some or all of them*. Configure every GC Connect form to the correct parameters such as IP address or serial port, poll interval, data destination, and so on. However, leave them and do not start any data capture operation. Next, go to the Comms menu > Start All Connections > **With Delay**. This menu displays the *GC Connect Delay Start* form.



On the left side, there is a list of *idle* GC Connect forms. Those with check mark will be queued for delay start. Reorder this queue by selecting one item and click **Move up** or **Move down**. GC Connect form at the top will be started first, and subsequently so according to the order of this queue.

If you tick **Delay the start of first GC Connect form**, the start capture operation of first GC Connect form in the queue will be delayed by the specified amount of time.

If you tick **Delay the start of subsequent GC Connect forms**, the start capture operation of the second, third, and the rest of the queue will be delayed by specified amount of time one after another. Furthermore if you tick **Randomise within**, the delay between GC Connect forms is randomised within the specified delay. For example, let's use 1 minute delay. Without randomisation, GCAS Desktop will start GC Connect forms in the given order exactly 1 minute one after another. With radomisation, the delay is randomised between immediate (0 second) to 1 minute. As an example, GCAS Desktop may start the second GC Connect form after 27 seconds, the third GC Connect form 56 seconds afterwards, and the fourth GC Connect form 43 seconds after the third.

Hit ▶ **Start timer** to begin the delay start. While the timer is running, a command link **Cancel** will appear to the right side of **Start timer** button. Click **Cancel** to stop the timer and abort the delay start.

Delay first GC Connect form check box is…	**Delay subsequent GC Connect forms** check box is…	What would happen
Checked, 10 minutes	Checked, 1 minute	1. GCAS Desktop waits 10 minutes then starts the first GC Connect form. 2. GCAS Desktop waits 1 minute then starts the second GC Connect form.

		3. GCAS Desktop waits 1 minute then starts the third GC Connect form, and similarly for the rest of queue.
Checked, 10 minutes	Unchecked	GCAS Desktop waits 10 minutes then start all GC Connect forms in the queue simultaneously.
Unchecked	Checked, 1 minute	1. GCAS Desktop starts the first GC Connect form immediately. 2. GCAS Desktop waits 1 minute then starts the second GC Connect form. 3. GCAS Desktop waits 1 minute then starts the third GC Connect form, and similarly for the rest of queue.
Unchecked	Unchecked	GCAS Desktop starts all GC Connect forms in the queue simultaneously and immediately. This configuration is the same as Comms menu > Start All Connections > Now.

If any of GC Connect forms in the queue is started manually or is closed before the timer countdown reaches zero, it is automatically removed from the queue. The GC Connect Delay Start form shall skip to the next GC Connect form in the queue. When this queue becomes empty, the timer stops.

26 Report

Under construction

Report is a planned module for printed report generation. A simple report typically contains latest calibration data, latest footprint, historical RF trend, RF error trend, RT trend, and RT error trend. Another type of reports include ISO 6976 trend and uncertainty trend.

Report module is not yet developed, but we reserved chapter 26 for report module. Our estimate is on GCAS Desktop version 1.9 or later, because development of ISO 6976 Trend takes priority. Stay tuned for future releases of GCAS Desktop.

27 Administrator Menu

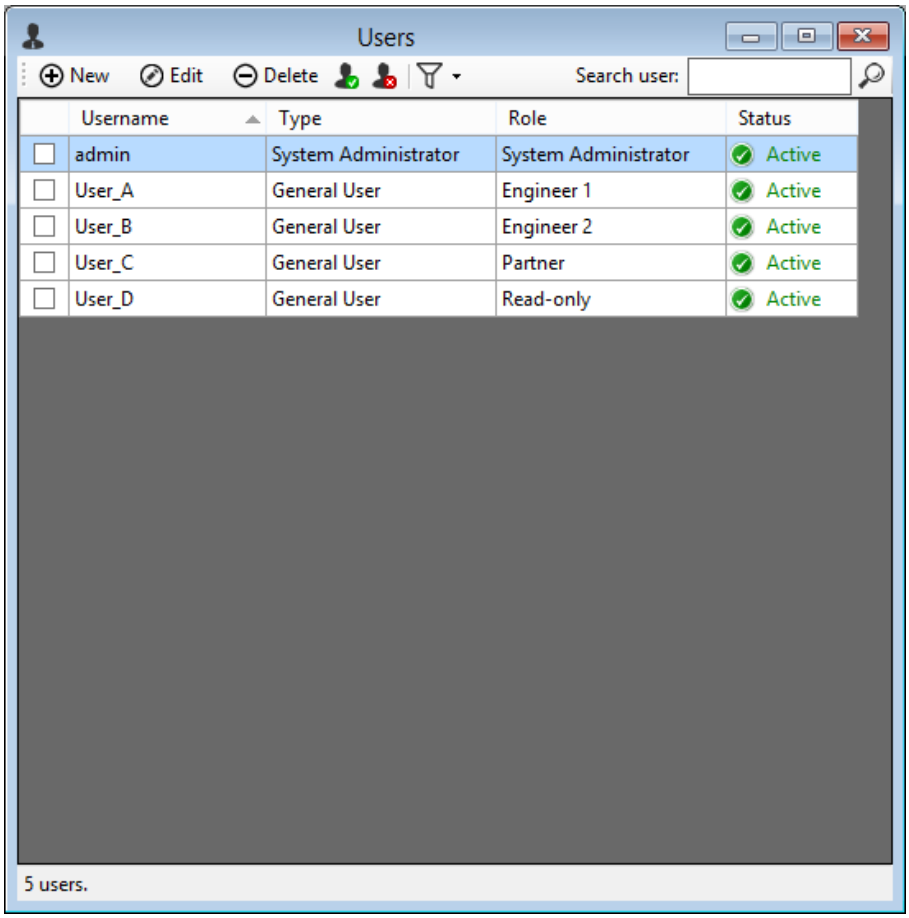
Administrator menu is available to GCAS administrators. Look for the "Administrator" menu on the menu bar of main user interface. Through this menu, GCAS administrators manage GCAS users, groups, and access control list.

Note

If your GCAS user account has a custom user type and your GCAS administrator granted the menu permission for "Options" for this user type, you would see Administrator menu as well. This implies you can manage users, groups, and optionally the access control list too.

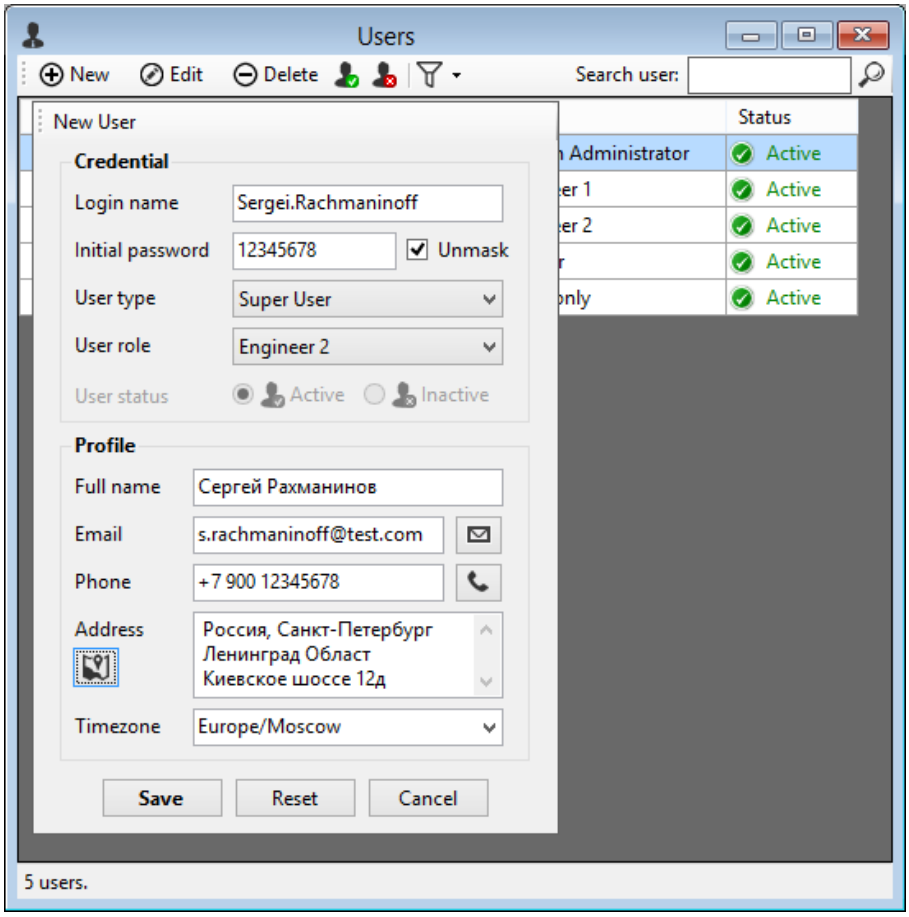
27.1 Manage Users

Go to Administrator menu > **Users**. This menu displays the *Users* form which lists all GCAS users registered in this GCAS database.



27.1.1 Create a New User

Click **New** button on the toolbar. Define the new username and initial password. Choose a user type and user role, and finally enter the information for his or her user profile. Finally, click **Save**.

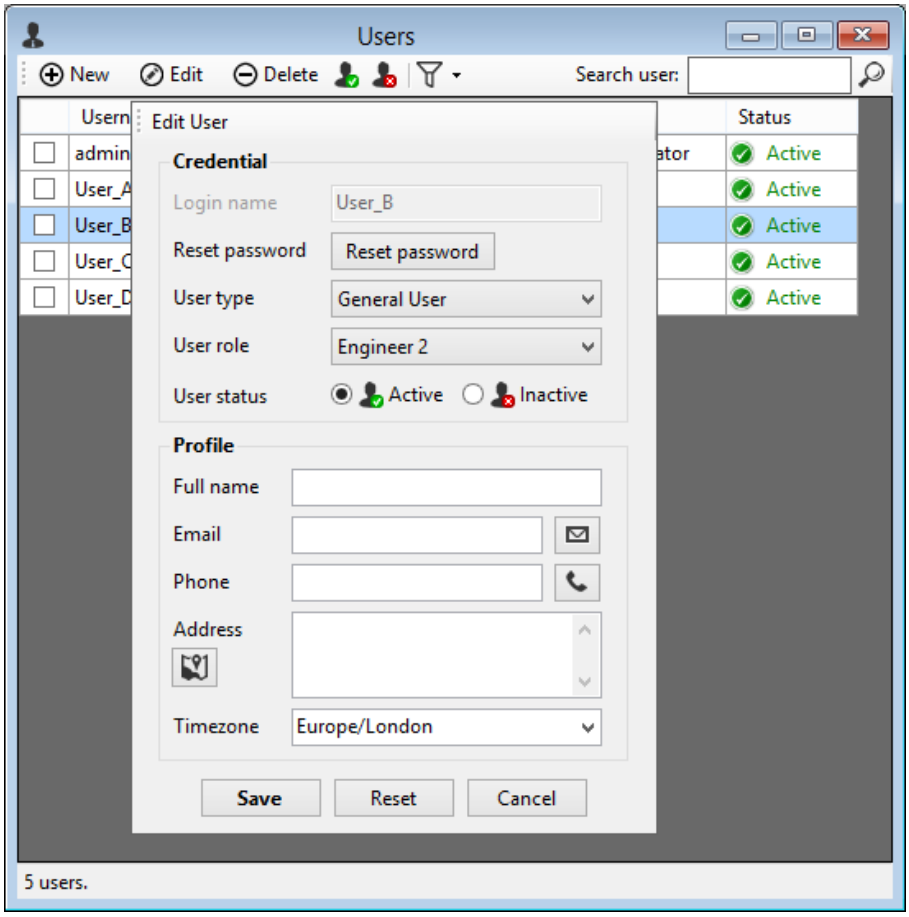


Note

1. Username cannot contain spaces.
2. Empty time zone information is replaced by the default `Europe/London` time zone.

27.1.2 Edit an Existing User

To edit a user, tick the user on the list and click the **Edit** button on the toolbar. Make changes as required then click **Save**. Otherwise click **Reset** to roll back to the previous user profile.



About reset password

You cannot alter the user's password directly, but you can rather reset it to the default password "**password**" (all lowercase). Do this on an explicit request from the user himself to reset his password.

To set user as inactive, edit the user and set his status as **Inactive**. Alternatively, tick multiple users on the list then click **Set as Inactive** button on the toolbar. Inactive users cannot log in to GCAS.

To set the user back as active again, edit the user then set her status as **Active**. Alternatively, tick multiple users on the list then click **Set as Active** button on the toolbar.

27.1.3 Delete Users

To delete one or more users, tick the user(s) you want to delete on the list then click **Delete** button on the toolbar.

Note

You cannot delete yourself. Ask another GCAS administrator to delete your user account to do so.

Warning

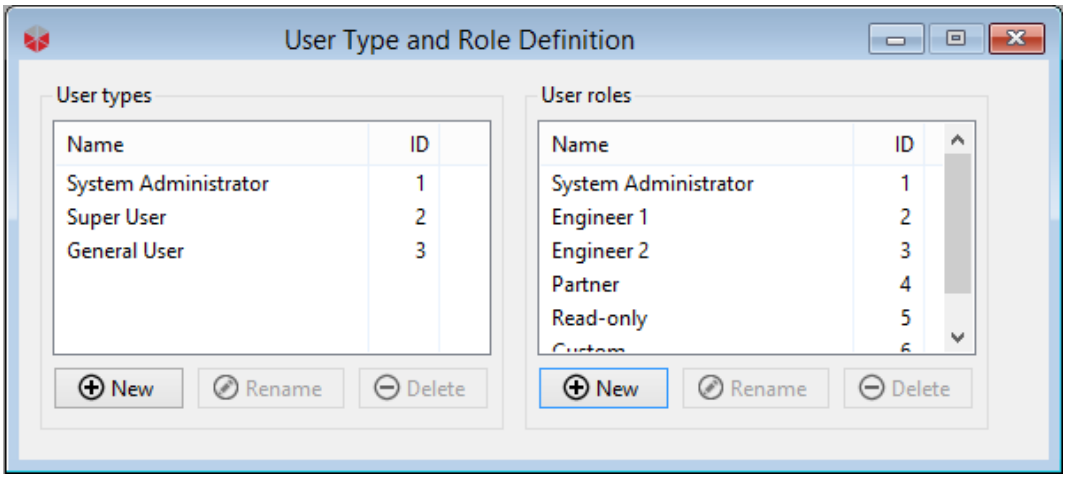
If the user being deleted is still logged in on another computer, deleting her account will cause errors on her computer. Make sure she has logged out beforehand.

Deleting users will also delete all their comments in any footprint, calibration data, mole composition, calibration gas certificate, data analysis, uncertainty trend, and repeatability test* records. If you need to preserve their comments, set them as inactive instead.

*available only on GCAS Web version.

27.2 Define New User Types and Roles

Default installation of GCAS Desktop sets up three user types and six user roles. Should you need to create another user type or user role, you would go to the Administrator menu > **User Type and Role Definition**.



Click **New** to create one. Click an existing user type or role and you can rename it via **Rename** button or delete it through the **Delete** button.

Note

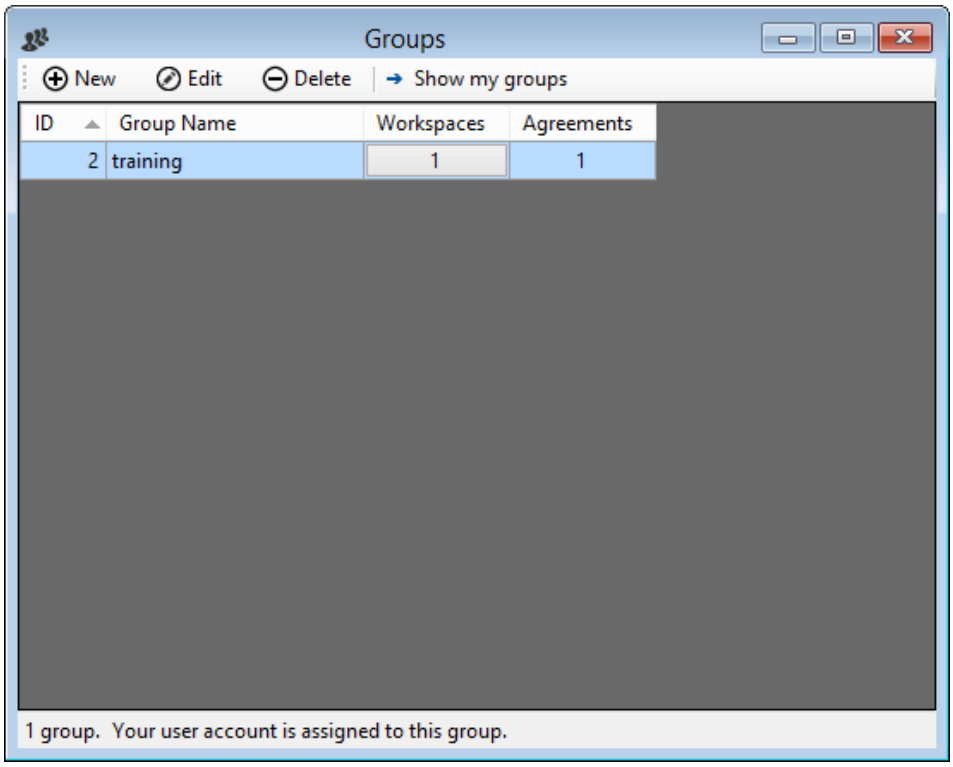
You cannot delete "System Administrator" user type and user role.

You cannot delete a user type or role if there are users of this type or role. Change the user type or role of these users before deleting the type or role.

Do not forget to assign menu permission for the new user type or action permission for the new user role, later.

27.3 Manage Groups

Go to the Administrator menu > **Groups and Workspaces** to manage groups. This menu displays the *Groups* form which lists all groups registered in the GCAS database. Note that your GCAS user account may not have been assigned to all these groups even though you are a GCAS administrator. Click **Show my groups** on the toolbar to highlight which groups are assigned to your user account.



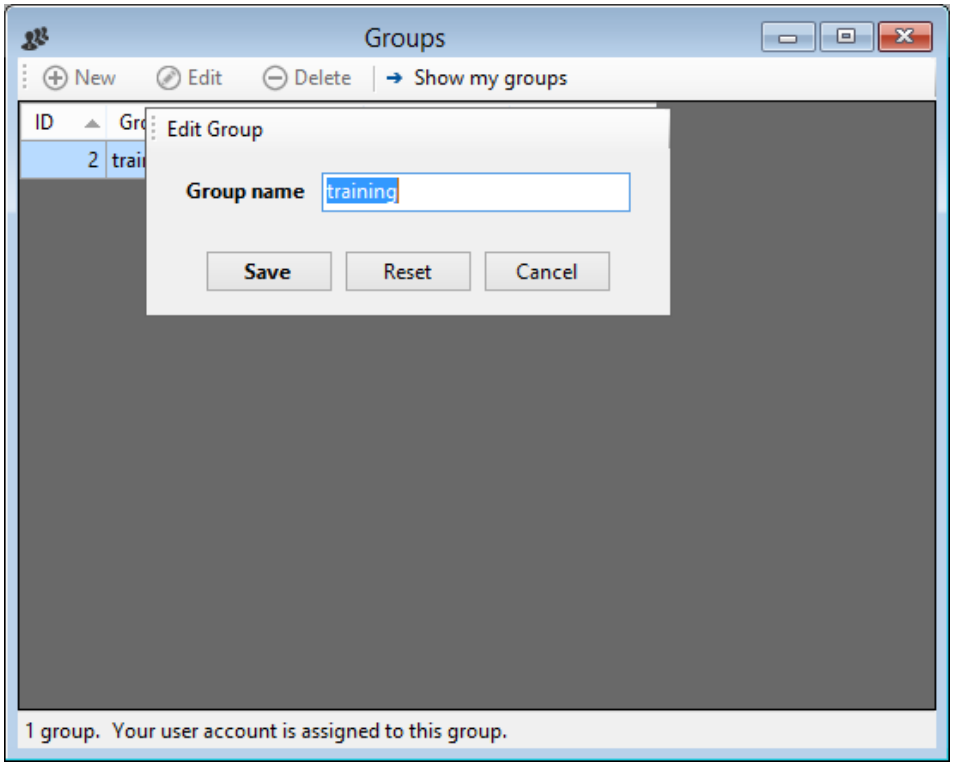
Note

The last column, **Agreements**, lists the number of agreements linked to the group. *Agreements are no longer part of GCAS Desktop*. However, the last column is preserved to maintain compatibility with older GCAS local-offline databases which were used before GCAS Desktop version 1.4 . It will be gone in GCAS Desktop version 2 where the database uses a completely new schema, and won't be compatible with any GCAS 1.*x* databases.

Agreement column should contain `1` (one) for every row. If any other number appears here, that indicates your offline database must be upgraded. Otherwise, you won't be able to delete the group. Contact i-Vigilant customer support to upgrade your offline database or use the supplied GCAS database upgrade tool.

27.3.1 Create, Edit, Delete Groups

To create a new Group, click **New** on the toolbar. Enter the group name, followed by business information of the company that is being represented by this new group. Finally, click **Save**. To edit a group, highlight the group on the list and then click **Edit** button on the toolbar. Similarly, to delete a group, highlight the group then click **Delete**.



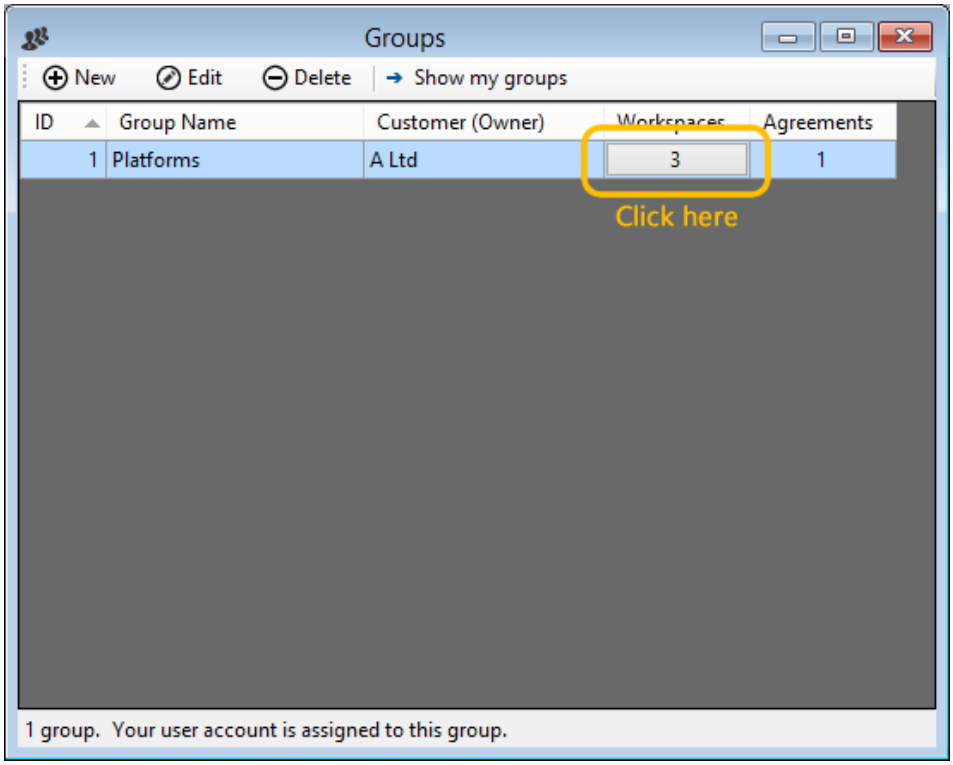
Note

Creating a group also creates one workspace within that group. The workspace has initially a same name as the group.

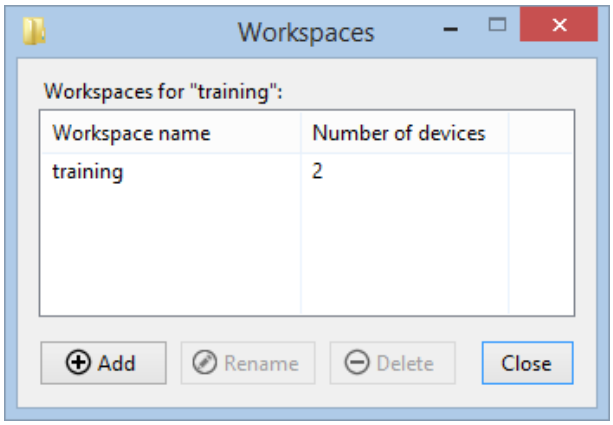
After a new group has been created, your user account is automatically assigned to the new group. Head to chapter 27.4 Assign Users into Groups if you don't like this assignment and to remove yourself from this group.

27.3.2 Add, Edit, Delete Workspace within Groups

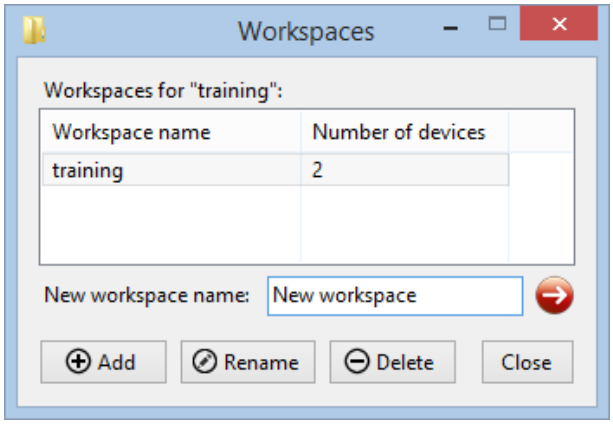
To edit workspaces within a group, click on the workspace count of that group.



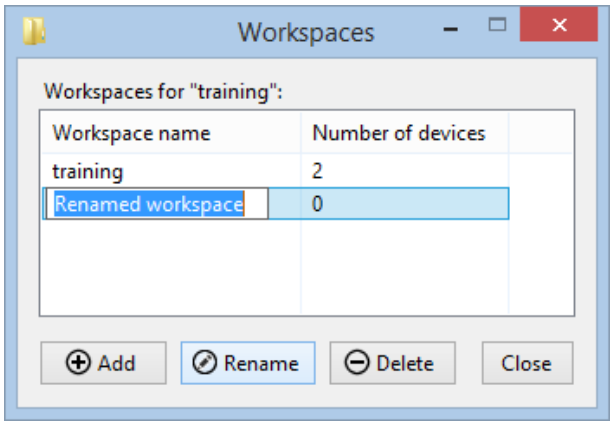
That button brings you to the *Workspaces* dialogue where you can manage workspaces for this group.



To define a new workspace, click **Add**. Enter the name of this new workspace then click the red arrow to commit.



Similarly, to rename a workspace you need to select the corresponding workspace on the list and then click **Rename**. Type the new name and press `Enter` on your keyboard to commit the change.



To delete a workspace, click the corresponding workspace on the list and then click **Delete**.

Note

You cannot delete a workspace if there are devices assigned to this workspace. Move them into a different workspace or delete the devices before deleting a workspace.

27.4 Assign Users into Groups

To assign users into groups or remove users from groups, go to the Administrator menu > **User-Group Relationship**. The menu takes you to the *User-Group Relationship* window.

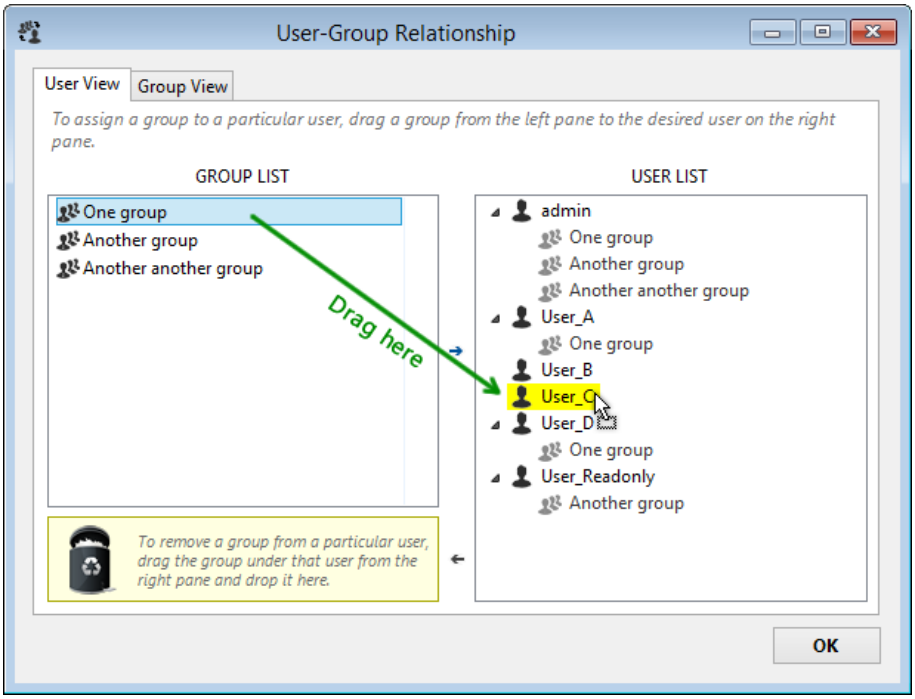
This form has two views: user view, and group view. Both carry the same information, but under different focus. Switch to user view if you want to focus on the users, i.e. how many groups one user has. Switch to group view if you want to focus on the groups, that is, how many users one group has.

Assigning and removing users or groups are conducted through drag-and-drop operations. Go to one of the subchapter below to use the form using a particular view.

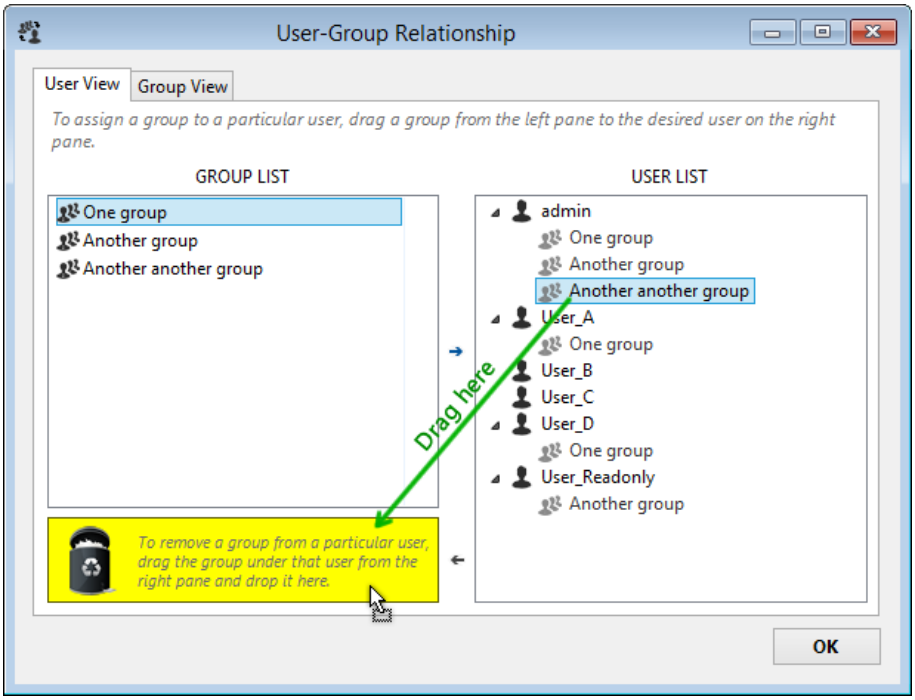
27.4.1 User View

User view focuses on the users. You see how many groups each user has.

Assign a group to a user: Drag the group from left pane to the user.



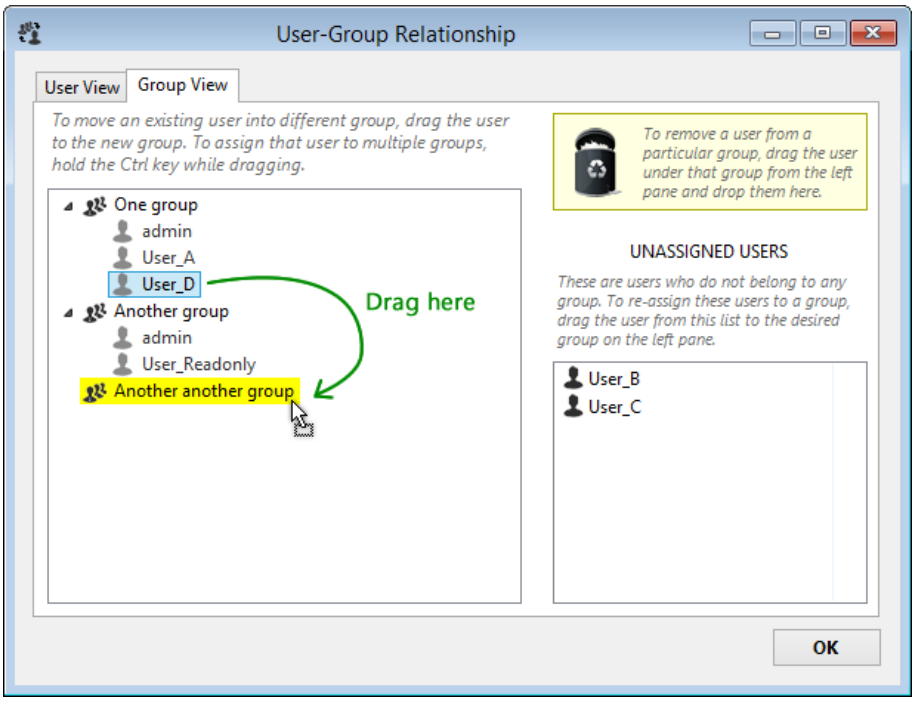
Remove a group from a user: Drag the group under a user and put it on the trash bin.



27.4.2 Group View

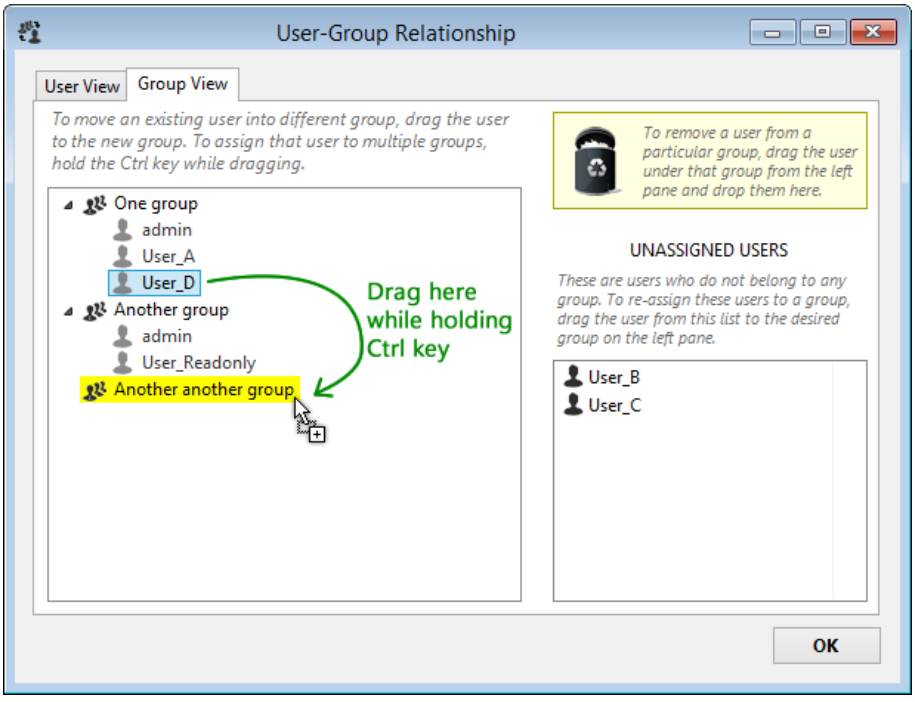
Group view focuses on the groups. You see how many users each group has.

Move a user to a new group: Drag a user to the new group. In this example, we are moving User D to a new group. User D loses access to *One group* but is given access to *Another another group*.

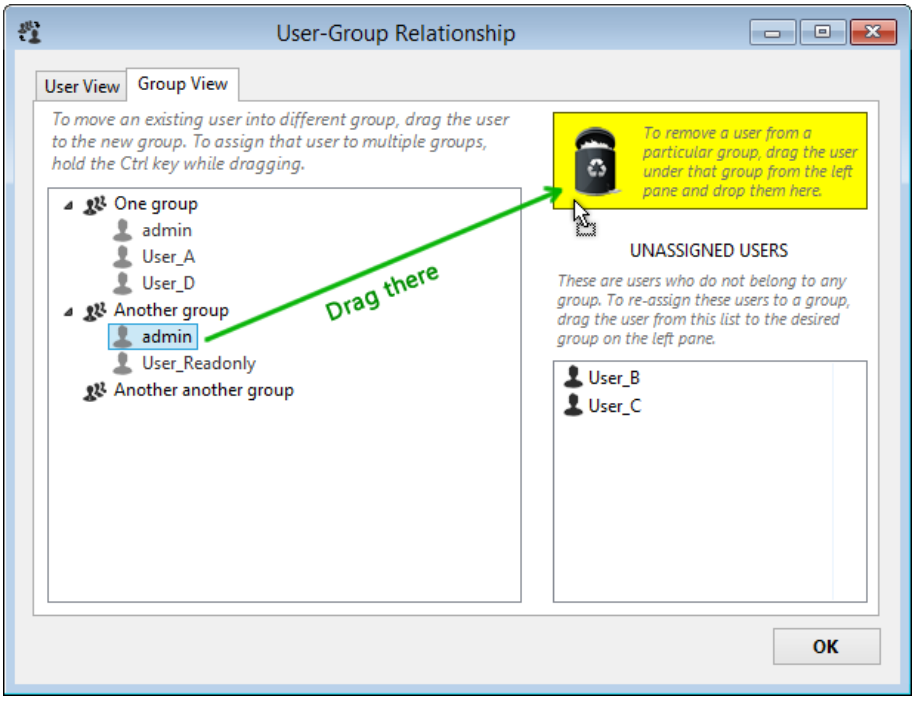

User-Group Relationship
User View
Group View
To move an existing user into different group, drag the user to the new group. To assign that user to multiple groups, hold the Ctrl key while dragging.
To remove a user from a particular group, drag the user under that group from the left pane and drop them here.
One group
admin
User_A
User_D
Another group
admin
User_Readonly
Another another group
Drag here
UNASSIGNED USERS
These are users who do not belong to any group. To re-assign these users to a group, drag the user from this list to the desired group on the left pane.
User_B
User_C
OK

Assign a user to a new group while retaining the previous one:

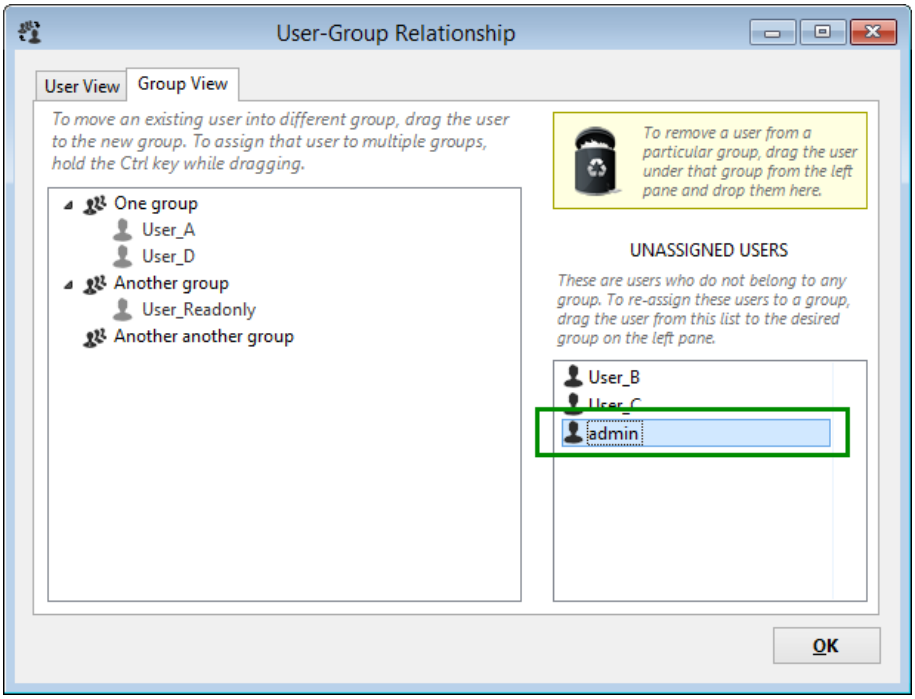
If you want to assign User D to both groups instead, hold the `Ctrl` key on your keyboard while dragging her to the new group. User D retains access to *One group* while is also being assigned to *Another another group*.


User-Group Relationship
User View
Group View
To move an existing user into different group, drag the user to the new group. To assign that user to multiple groups, hold the Ctrl key while dragging.
To remove a user from a particular group, drag the user under that group from the left pane and drop them here.
One group
admin
User_A
User_D
Another group
admin
User_Readonly
Another another group
Drag here while holding Ctrl key
UNASSIGNED USERS
These are users who do not belong to any group. To re-assign these users to a group, drag the user from this list to the desired group on the left pane.
User_B
User_C
OK

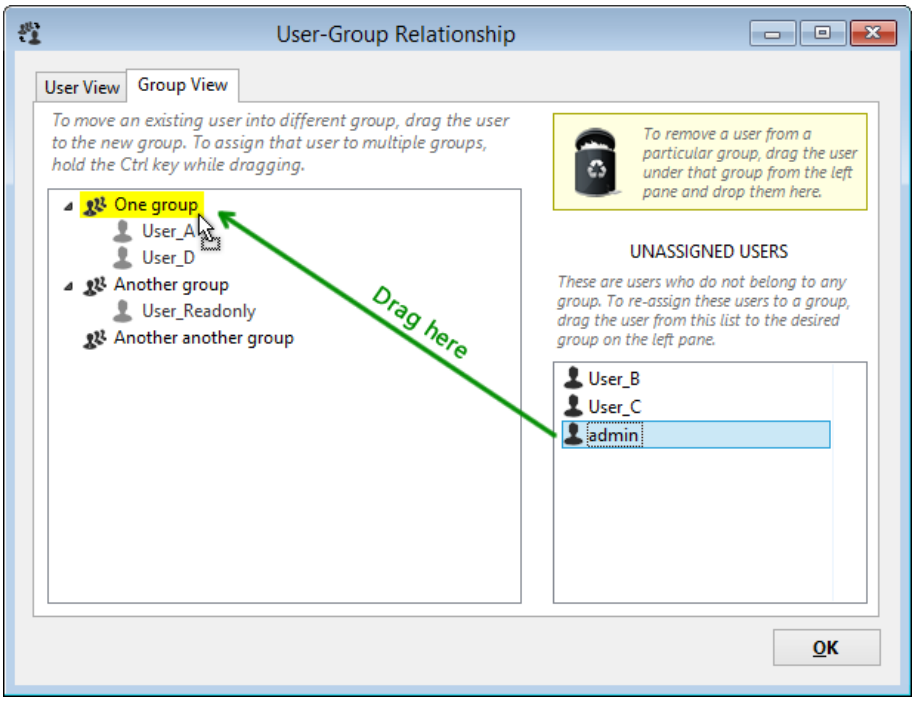
Remove a user from a group: Drag the user under a group and put him on the trash bin icon.


User-Group Relationship
User View
Group View
To move an existing user into different group, drag the user to the new group. To assign that user to multiple groups, hold the Ctrl key while dragging.
To remove a user from a particular group, drag the user under that group from the left pane and drop them here.
One group
admin
User_A
User_D
Another group
admin
User_Readonly
Another another group
Drag there
UNASSIGNED USERS
These are users who do not belong to any group. To re-assign these users to a group, drag the user from this list to the desired group on the left pane.
User_B
User_C
OK

Unassigned users: If you remove the same user from *every* group she had, she will appear on the list of unassigned users.

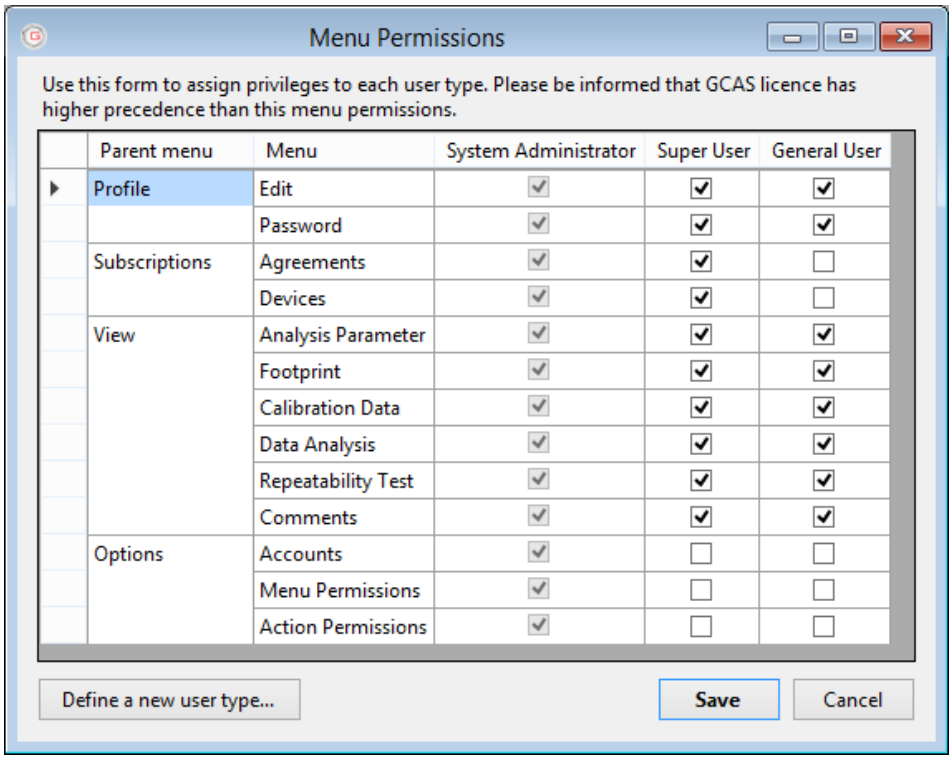

User-Group Relationship
User View
Group View
To move an existing user into different group, drag the user to the new group. To assign that user to multiple groups, hold the Ctrl key while dragging.
To remove a user from a particular group, drag the user under that group from the left pane and drop them here.
One group
User_A
User_D
Another group
User_Readonly
Another another group
UNASSIGNED USERS
These are users who do not belong to any group. To re-assign these users to a group, drag the user from this list to the desired group on the left pane.
User_B
admin
OK

Reassign an unassigned user to a group: To reassign an unassigned user back to a group, drag her to the desired group.


User-Group Relationship
User View
Group View
To move an existing user into different group, drag the user to the new group. To assign that user to multiple groups, hold the Ctrl key while dragging.
To remove a user from a particular group, drag the user under that group from the left pane and drop them here.
One group
User_A
User_D
Another group
User_Readonly
Another another group
Drag here
UNASSIGNED USERS
These are users who do not belong to any group. To re-assign these users to a group, drag the user from this list to the desired group on the left pane.
User_B
User_C
admin
OK

27.5 Menu Permissions

Menu permissions are a part of access control list (ACL) that controls which menu is available to each user type. Go to the Administrator menu > **Menu Permissions** to show the *Menu Permissions* form.


Menu Permissions
Use this form to assign privileges to each user type. Please be informed that GCAS licence has higher precedence than this menu permissions.
Define a new user type...
Save
Cancel

Parent menu	Menu	System Administrator	Super User	General User
Profile	Edit	☑	☑	☑
	Password	☑	☑	☑
Subscriptions	Agreements	☑	☑	☐
	Devices	☑	☑	☐
View	Analysis Parameter	☑	☑	☑
	Footprint	☑	☑	☑
	Calibration Data	☑	☑	☑
	Data Analysis	☑	☑	☑
	Repeatability Test	☑	☑	☑
	Comments	☑	☑	☑
Options	Accounts	☑	☐	☐
	Menu Permissions	☑	☐	☐
	Action Permissions	☑	☐	☐

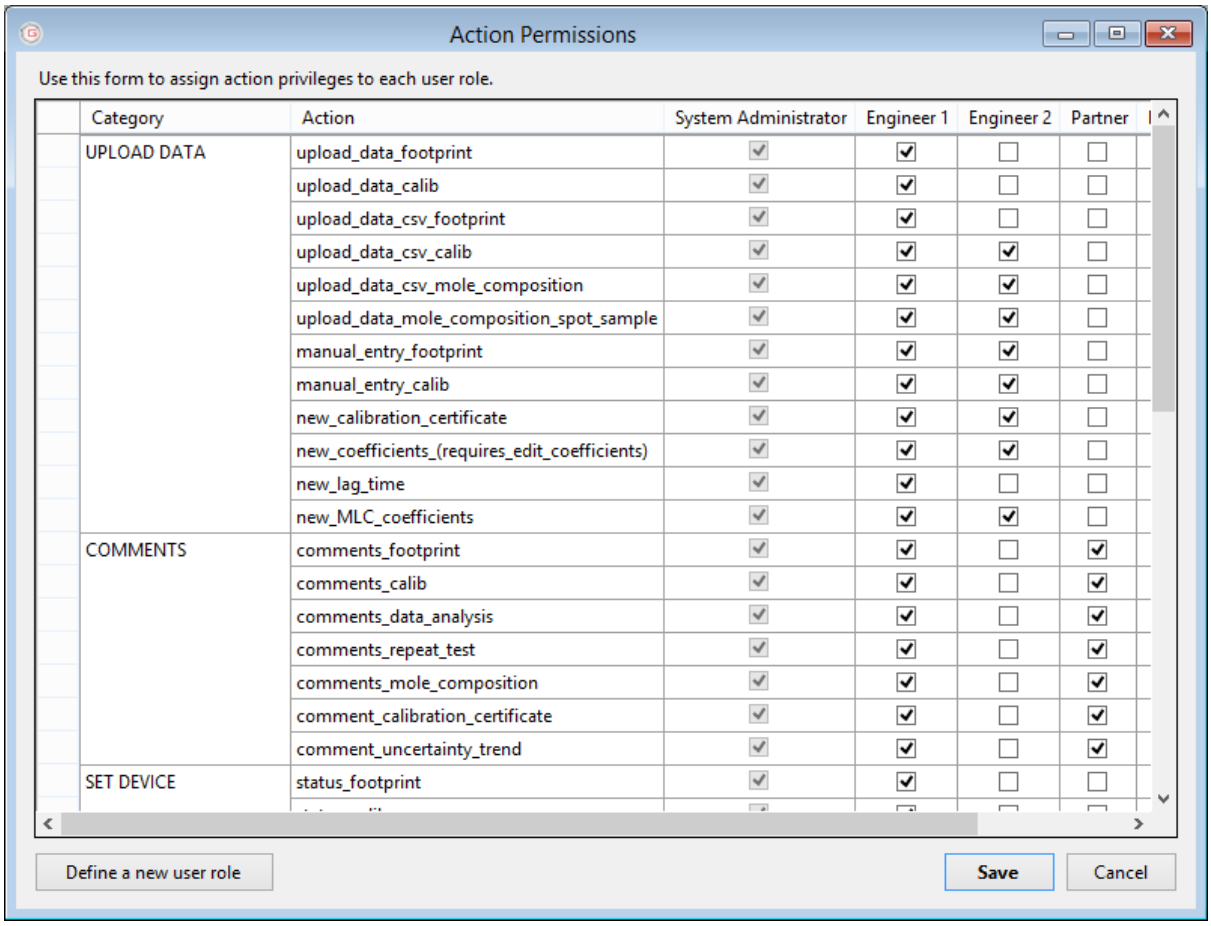
To grant or revoke permissions, tick or untick the corresponding check box. Administrator always has access to all menus. Click **Save** to enforce the change. If other GCAS users are currently logged in to GCAS database on other computers, the change will take effect on their user accounts after they log out or exit GCAS Desktop.

Information

Many menus such as Comms menu, File menu > Export Data, Tools menu *could* be included in this menu permission list. However, if you use i-Vigilant central database, the database is shared between GCAS Desktop and GCAS Web. Unfortunately, adding new entries to this menu permission list would break GCAS Web.

27.6 Action Permissions

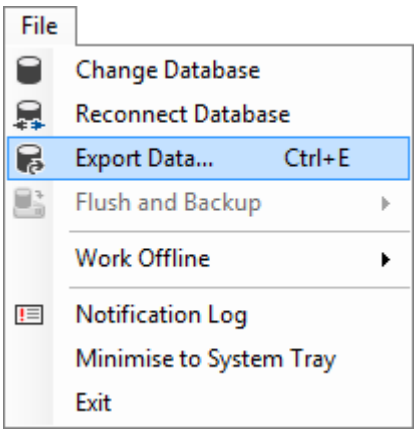
In tandem with menu permissions, action permissions constitutes the access control list (ACL). Action permissions control which *action menus* — and in some cases, *actions* in literal meaning itself — available to each user role. Go to Administrator menu > **Action Permissions** to bring forth the *Action Permissions* form.

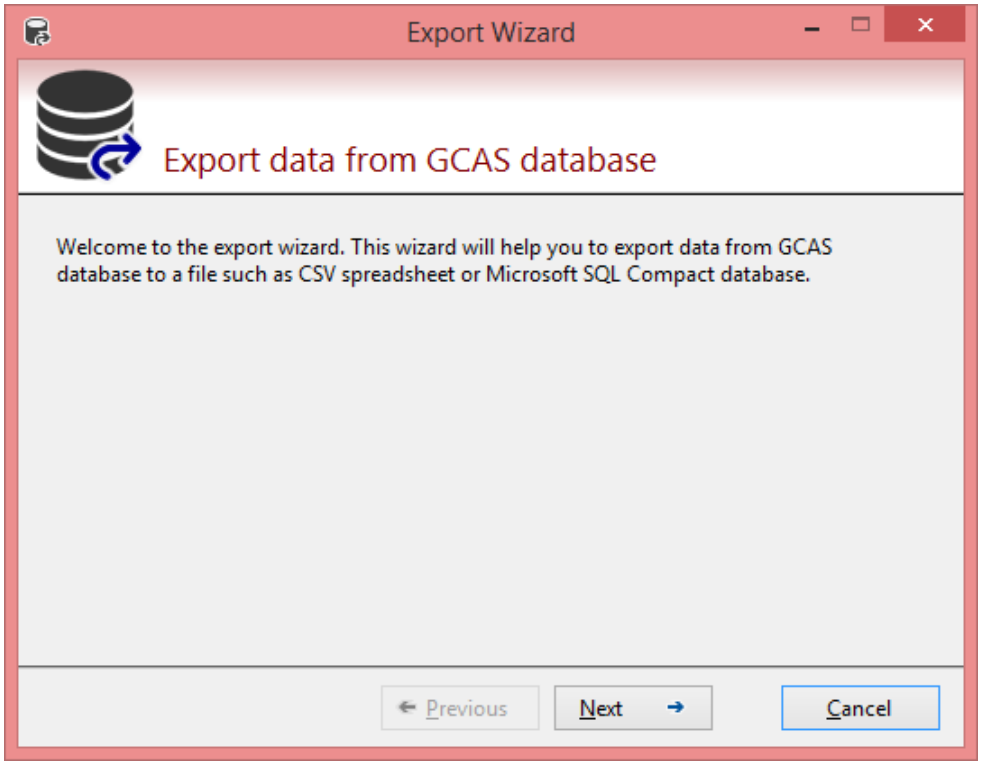


Similar to menu permissions, tick the check box to grant permission or untick to revoke. Click **Save** to enforce the change. If other GCAS users are currently logged in to GCAS database on other computers, the change will take effect on their user accounts after they log out or exit GCAS Desktop.

28 Export Data

GCAS Desktop can export a portion of GCAS database into several file formats for further analysis. Go to the File menu > **Export Data** and the *Export Wizard* window shall appear. If you don't see this menu, that means you do not have any GCAS feature related to data export in your GCAS licence.




Export Wizard
Export data from GCAS database
Welcome to the export wizard. This wizard will help you to export data from GCAS database to a file such as CSV spreadsheet or Microsoft SQL Compact database.
Previous
Next
Cancel

The Export Wizard.

Note

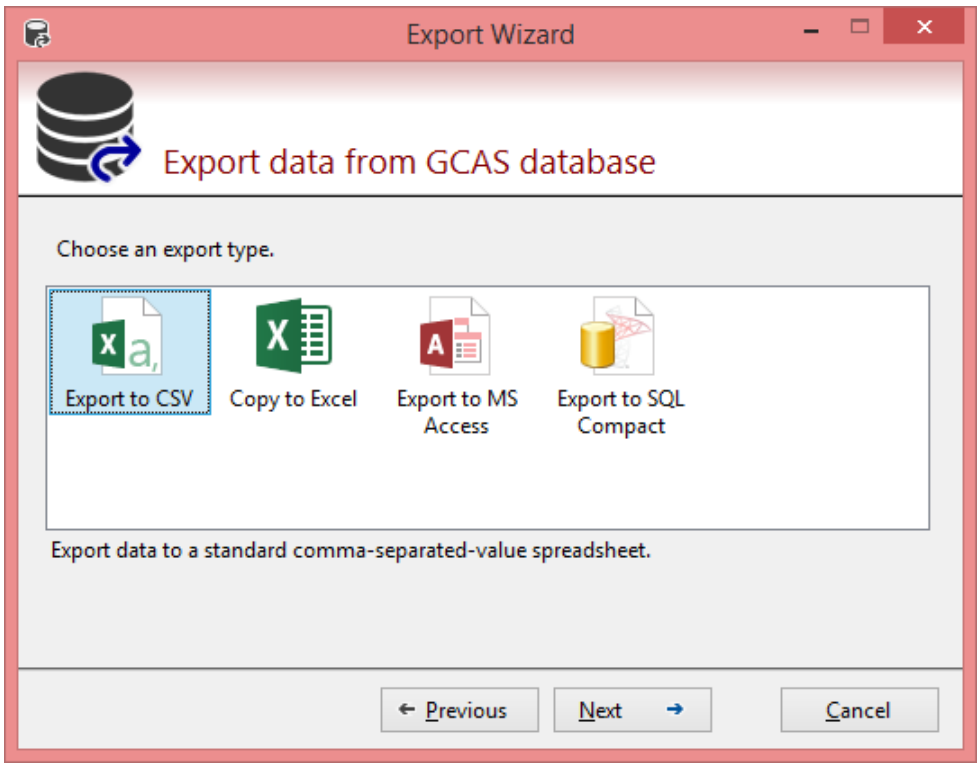
If you are working offline, only the data available in your temporary database—which is a subset of GCAS database—can be exported. If you choose to synchronise your data for the latest 6 months for instance, you cannot export data beyond 6 months ago.

28.1 Export to CSV

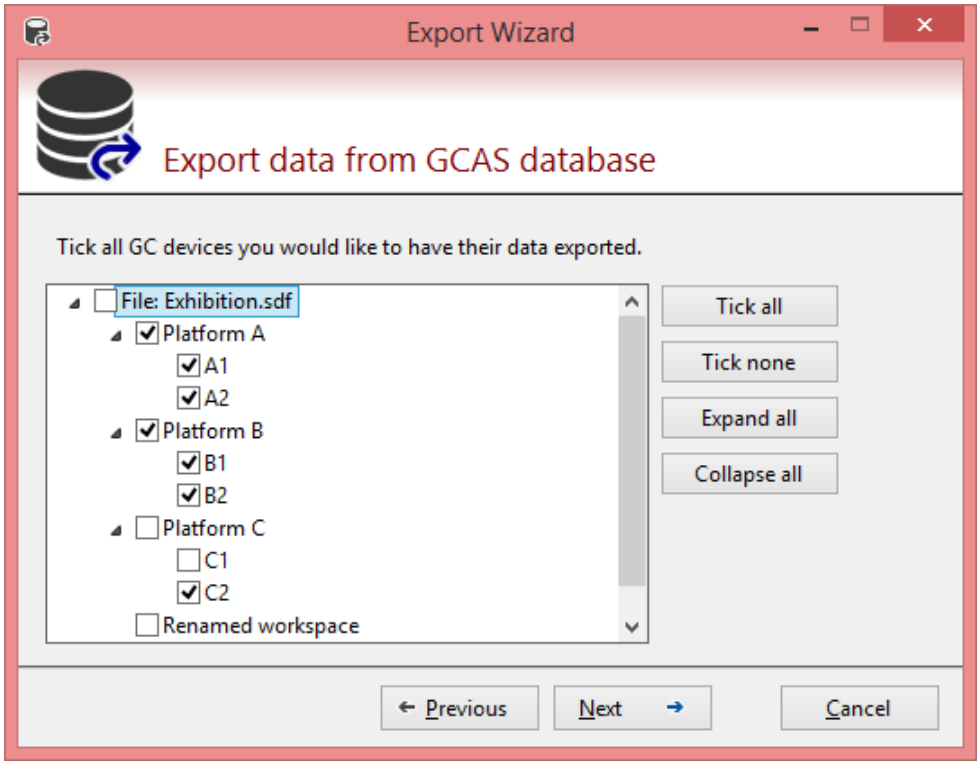
This exporter module exports GCAS data into a standard comma-separated value (CSV) spreadsheet. Choose **Export to CSV** to begin.

Note

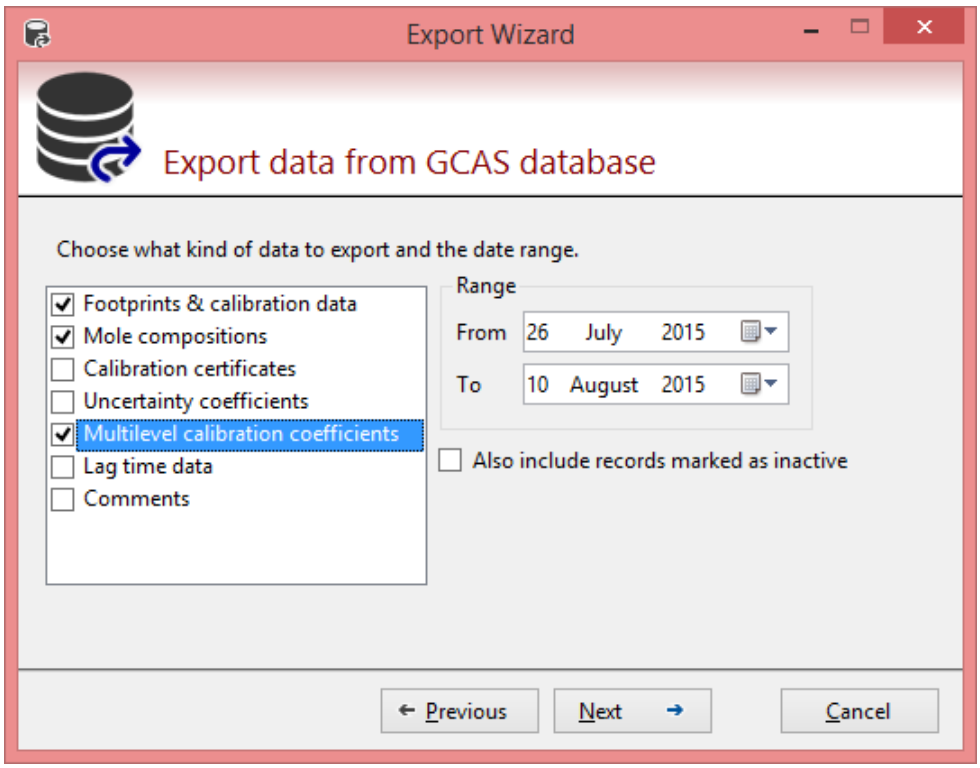
You need the GCAS feature *Export to CSV* to be included in your GCAS licence in order to use this feature.



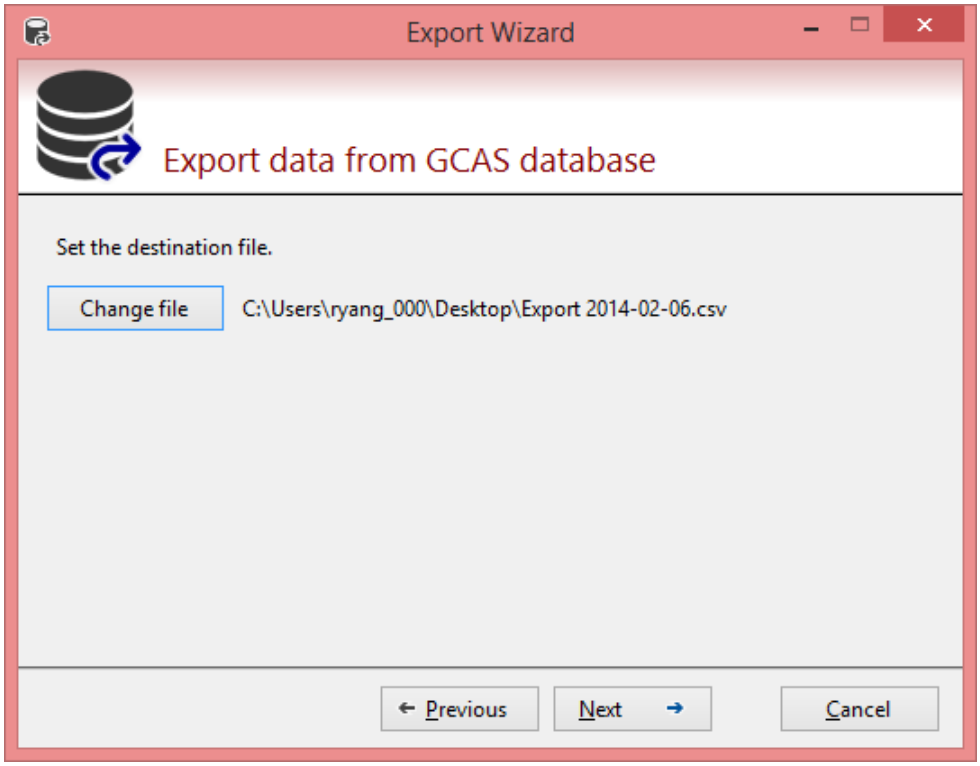
Tick all GC devices you would like to have their data exported.



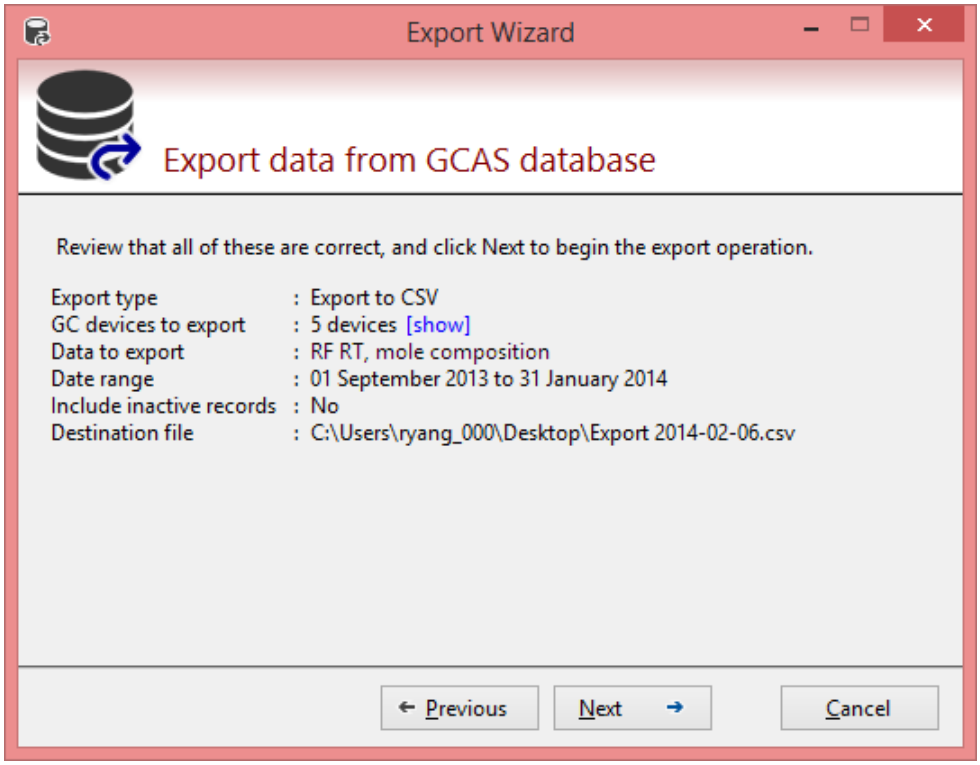
Choose the data kind and a date range to export. If you tick **Also include records marked as inactive**, inactive footprints, calibration data, mole composition data, calibration certificates, uncertainty coefficients, MLC coefficients, and lag time data, including comments for them (if selected) within the defined date range will also be included in the export.



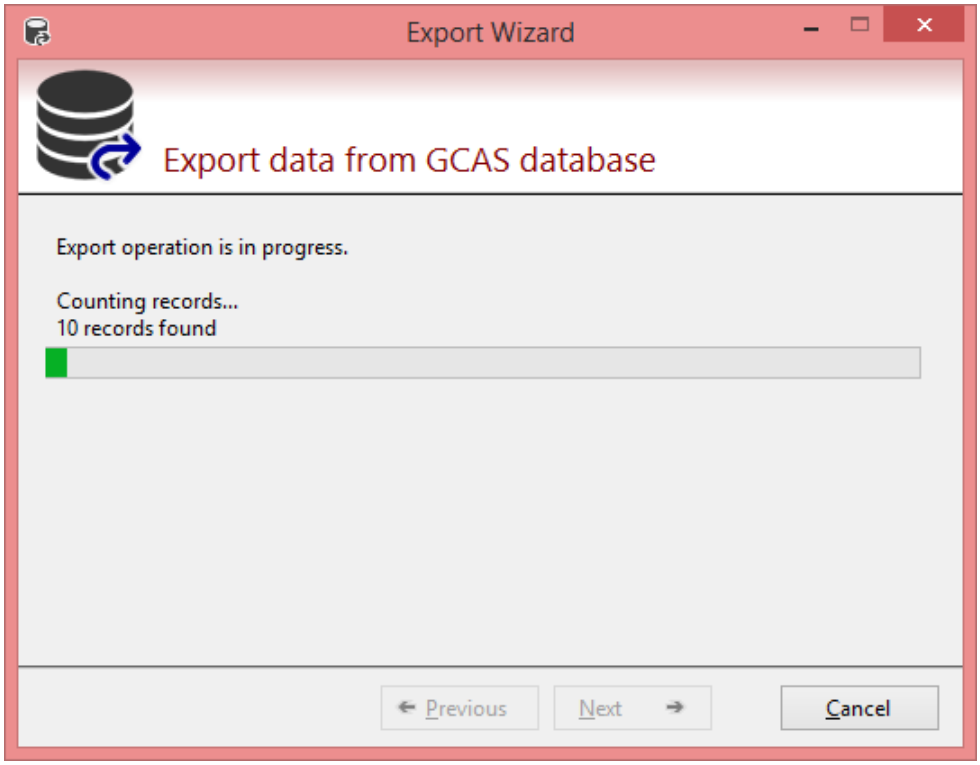
Set the destination CSV file.



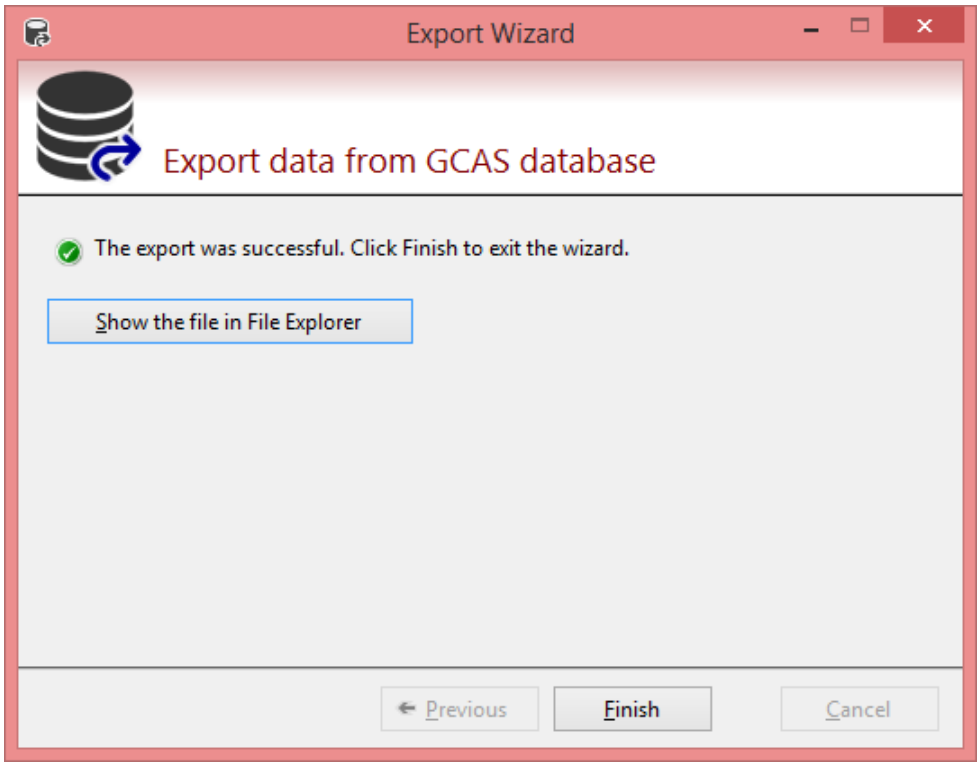
Review the export settings, and click **Next** to begin the export process.


Export Wizard
Export data from GCAS database
Review that all of these are correct, and click Next to begin the export operation.
Export type : Export to CSV
GC devices to export : 5 devices [show]
Data to export : RF RT, mole composition
Date range : 01 September 2013 to 31 January 2014
Include inactive records : No
Destination file : C:\Users\ryang_000\Desktop\Export 2014-02-06.csv
Previous
Next
Cancel

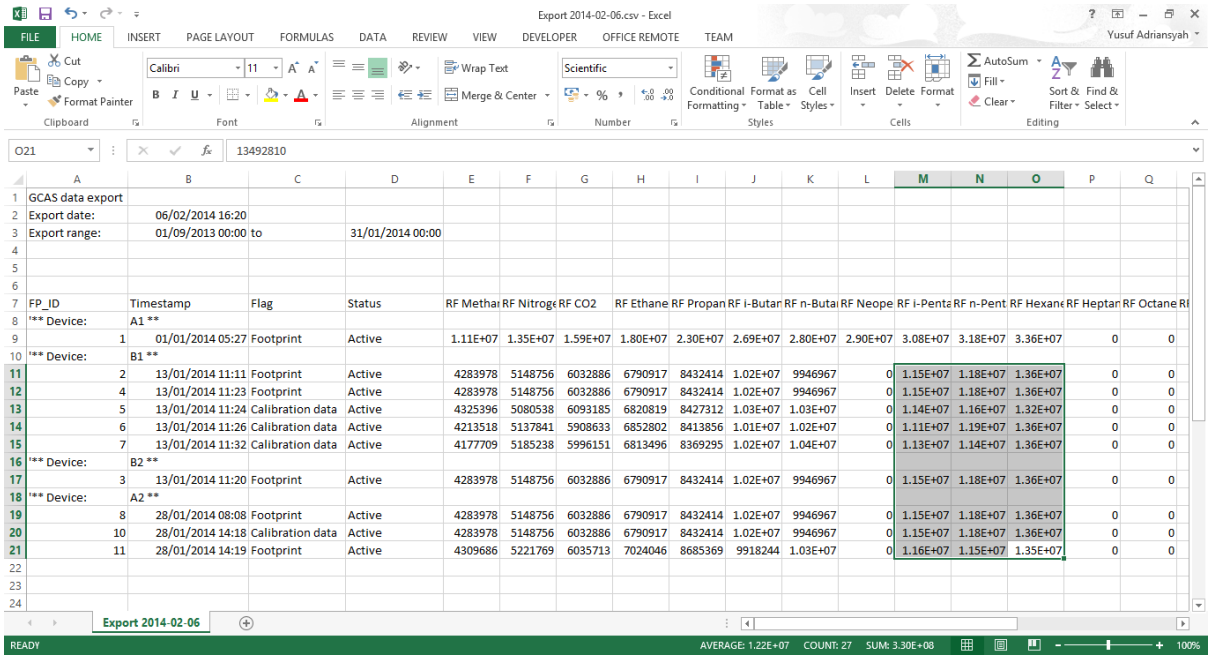
GCAS Desktop commences the export operation. For CSV export, this step is typically very fast — unless the number of records to export is way too many.



This wizard page confirms that the export has been successful. You can now open the CSV file.



A quick note if you open the CSV file using Microsoft Excel. Excel tends to truncate large number into scientific notation up to 2 decimal place (the number of decimal place follows the regional settings on your Windows Control Panel). **This truncation may lead to large rounding error and is permanent**. As soon as you notice this Excel evildoing, change the number format for the selected cells to general numeric format before you save the file.



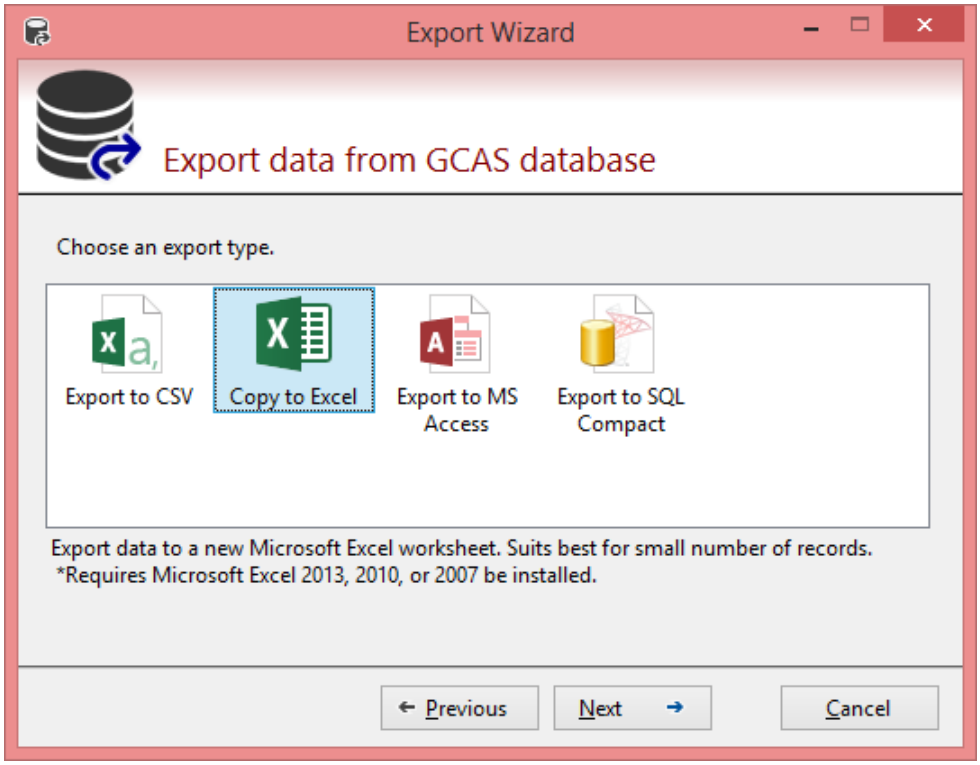
28.2 Copy to Microsoft Excel

This exporter module opens a new Microsoft Excel worksheet, formats the worksheet, and writes data to it. The process is much slower compared to other exporter module, so it is suitable for small number of records. Choose **Copy to Excel** to begin.

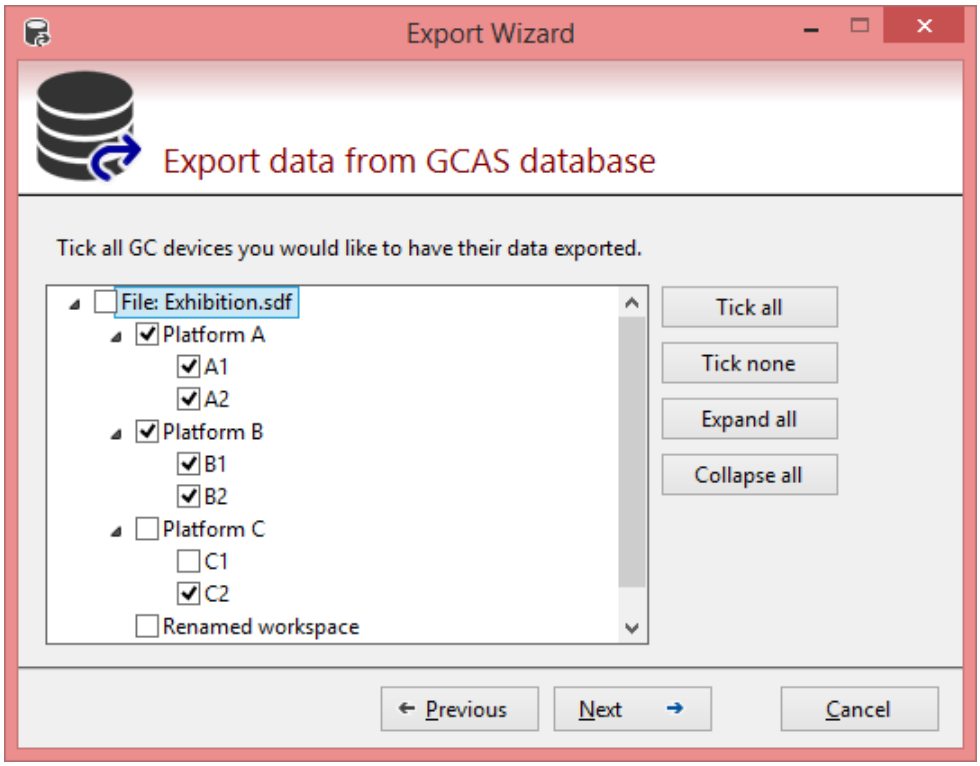
Note

You need the GCAS feature *Export to Microsoft Office* to be included in your GCAS licence in order to use this feature.

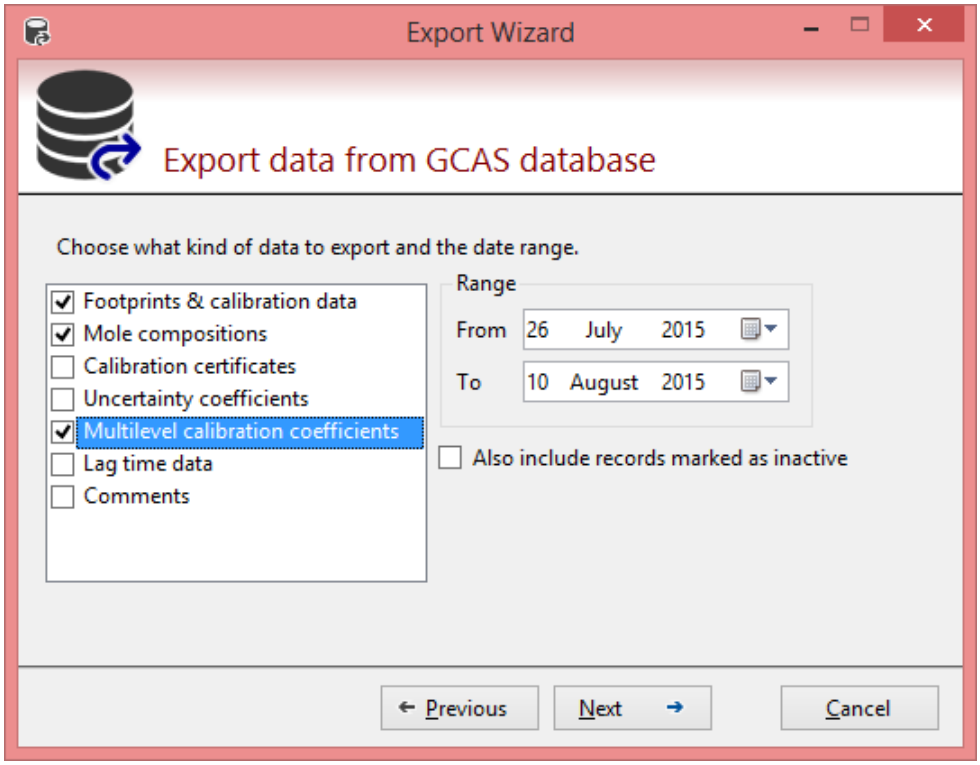
Moreover, this exporter also requires Microsoft Excel 2010, 2013, 2016, or later to be installed on your computer. Running this export module without Excel installed will raise an error.


Export Wizard
Export data from GCAS database
Choose an export type.
Export to CSV
Copy to Excel
Export to MS Access
Export to SQL Compact
Export data to a new Microsoft Excel worksheet. Suits best for small number of records.
*Requires Microsoft Excel 2013, 2010, or 2007 be installed.
Previous
Next
Cancel

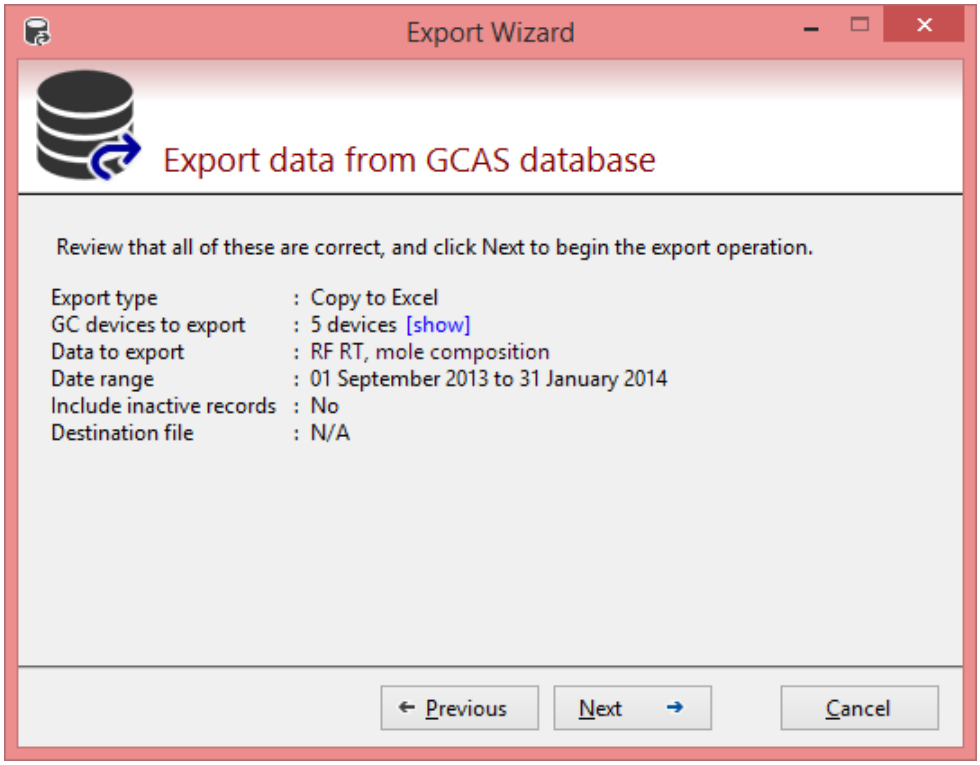
Tick all GC devices you would like to have their data exported.



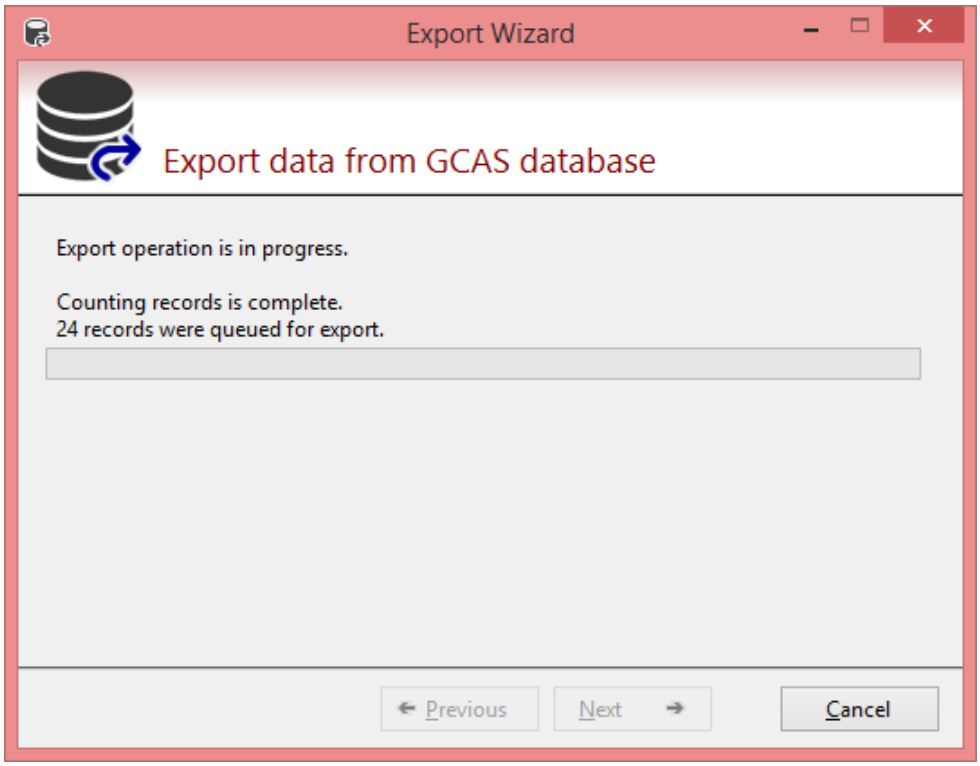
Choose the data kind and a date range to export. If you tick **Also include records marked as inactive**, inactive footprints, calibration data, mole composition data, calibration certificates, uncertainty coefficients, MLC coefficients, and lag time data, including comments for them (if selected) within the defined date range will also be included in the export.



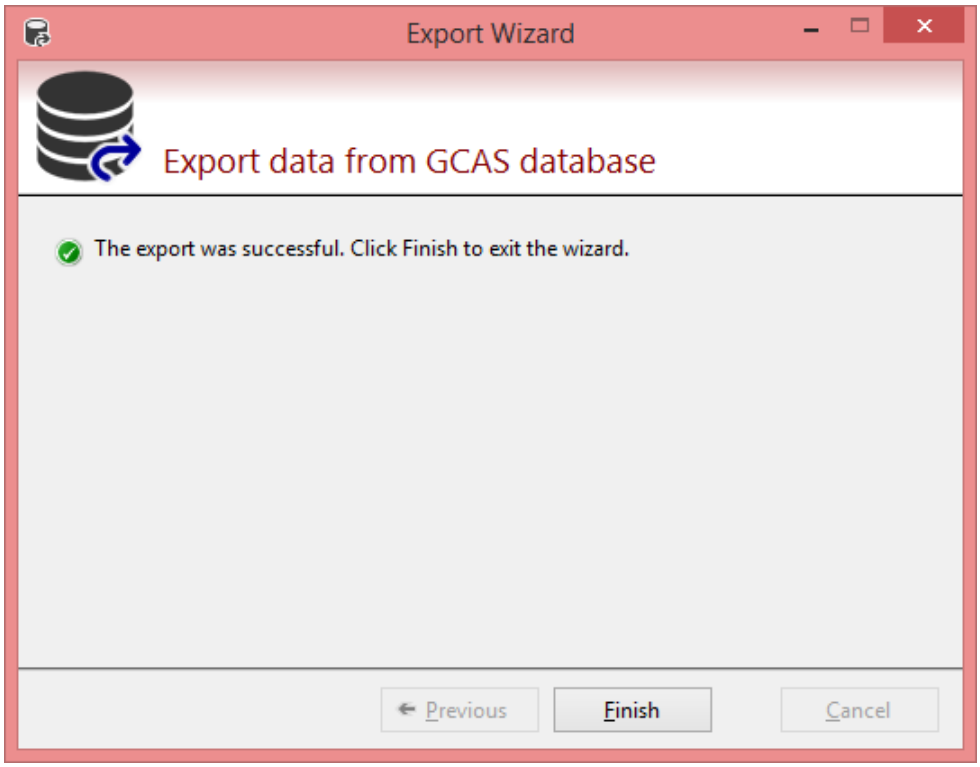
Unlike other export modules, you don't set the destination file. Review the export parameters and click **Next** to continue.


Export Wizard
Export data from GCAS database
Review that all of these are correct, and click Next to begin the export operation.
Export type : Copy to Excel
GC devices to export : 5 devices [show]
Data to export : RF RT, mole composition
Date range : 01 September 2013 to 31 January 2014
Include inactive records : No
Destination file : N/A
Previous
Next
Cancel

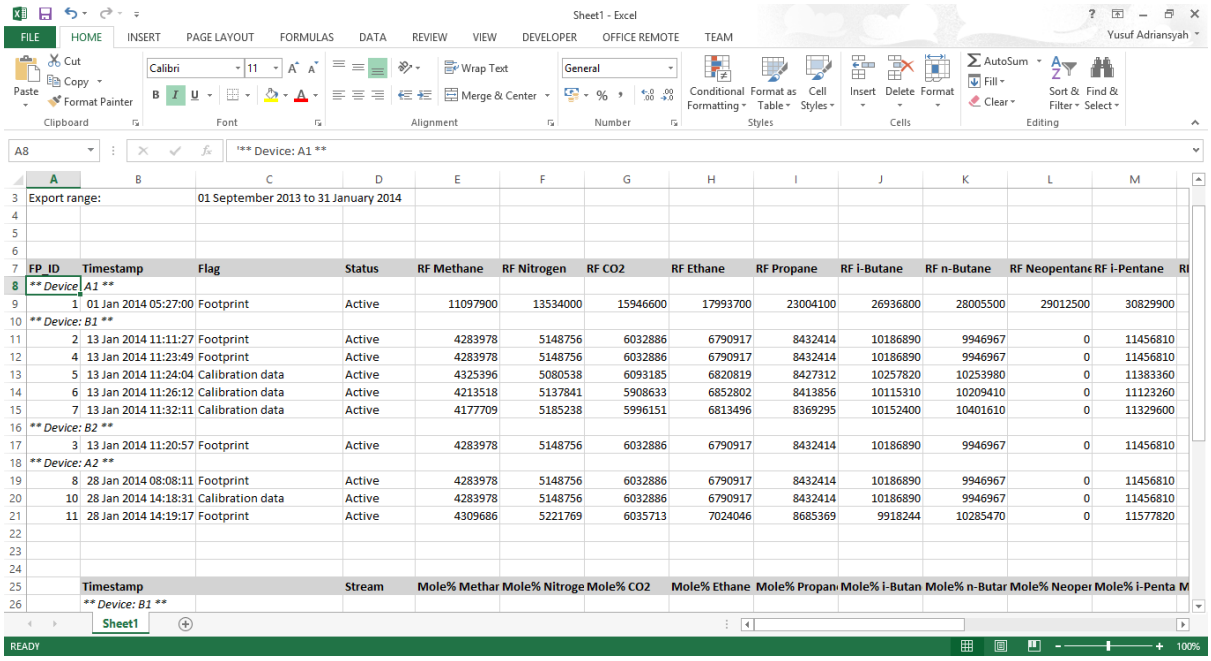
GCAS Desktop commences the export operation. On this screen you should see a new window of Microsoft Excel opens (possibly minimised in background). If you switch to that Microsoft Excel window, you see GCAS data is being written to the worksheet.



For large number of records, the process may take a prolonged time. Do not close Microsoft Excel until GCAS Desktop displays the final wizard page:



This is an example Microsoft Excel worksheet after export process is finished.



28.3 Export to Microsoft Access

This exporter module exports GCAS data to Microsoft Access database file (.accdb). *Unlike the SQL Compact export, the export result is **not** a GCAS database thus you **cannot** use it as "local offline" database*. The export result is a simple Microsoft Access database intended for further analysis.

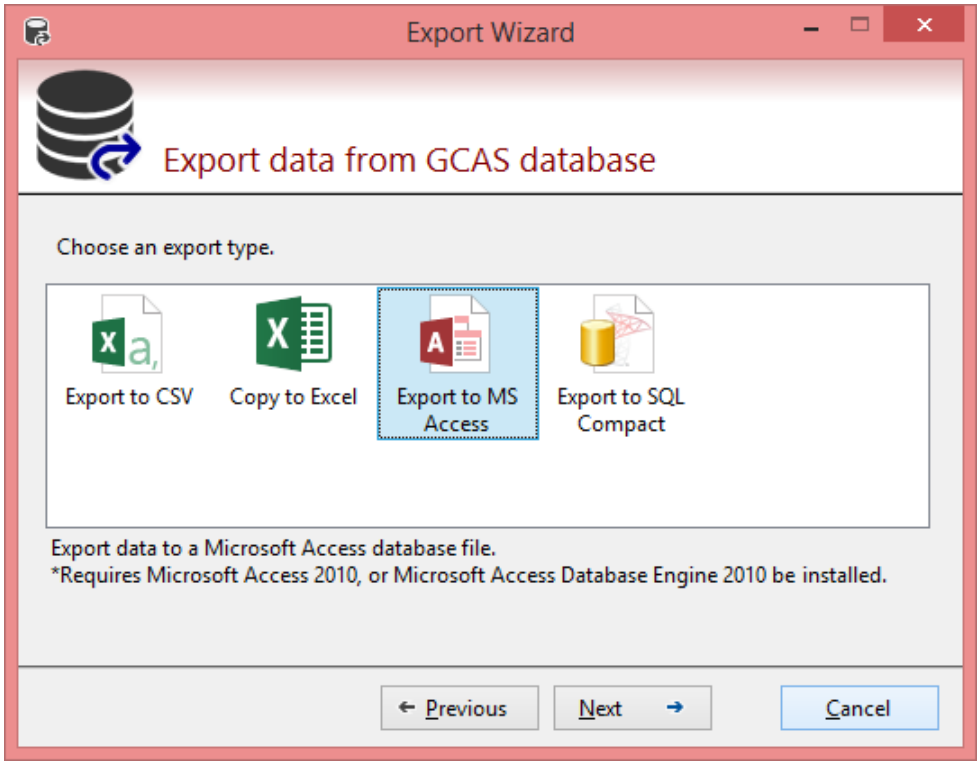
Note

You need the GCAS feature *Export to Microsoft Office* to be included in your GCAS licence in order to use this feature. Additionally, this exporter also requires just one of these...

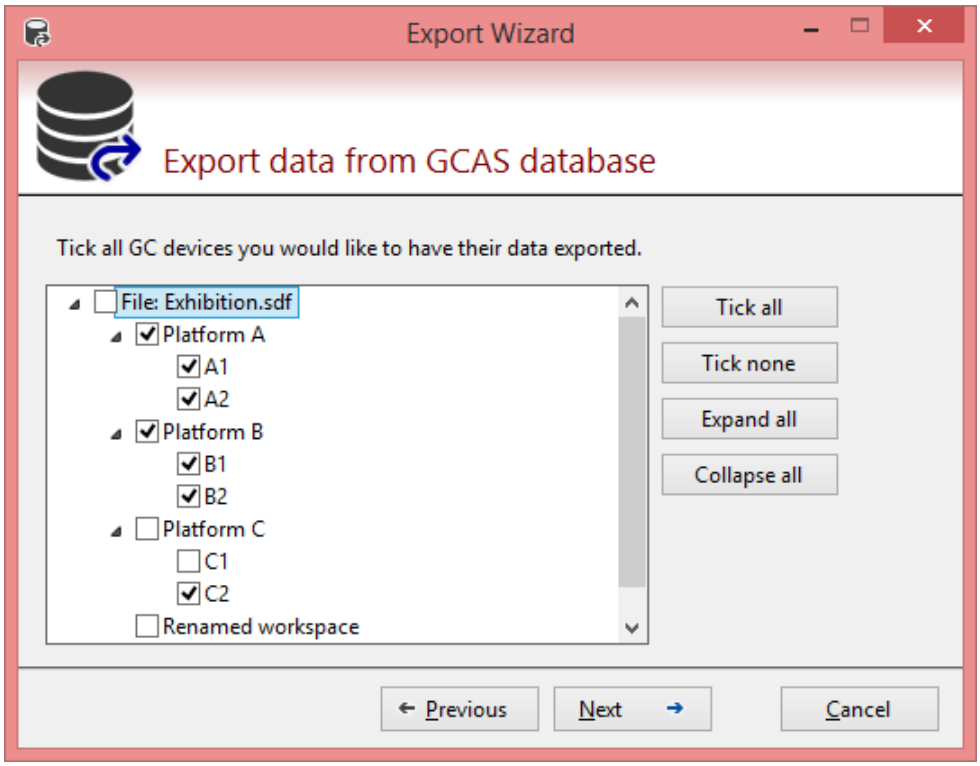
- Microsoft Access 2010,
- Microsoft Access Database Engine 2010,
- Microsoft Access 2013 **32-bit**, or
- Microsoft Access Runtime 2013 **32-bit** (the 64-bit won't work)

...to be installed on your computer.

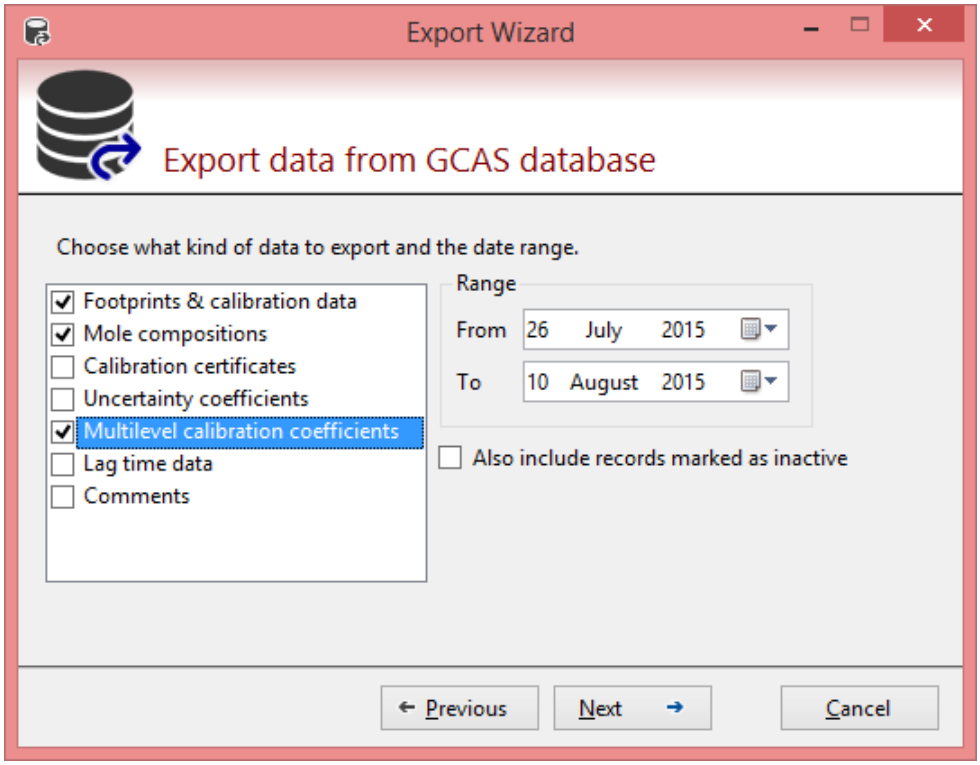
Choose **Export to MS Access** to begin.


Export Wizard
Export data from GCAS database
Choose an export type.
Export to CSV
Copy to Excel
Export to MS Access
Export to SQL Compact
Export data to a Microsoft Access database file.
*Requires Microsoft Access 2010, or Microsoft Access Database Engine 2010 be installed.
Previous
Next
Cancel

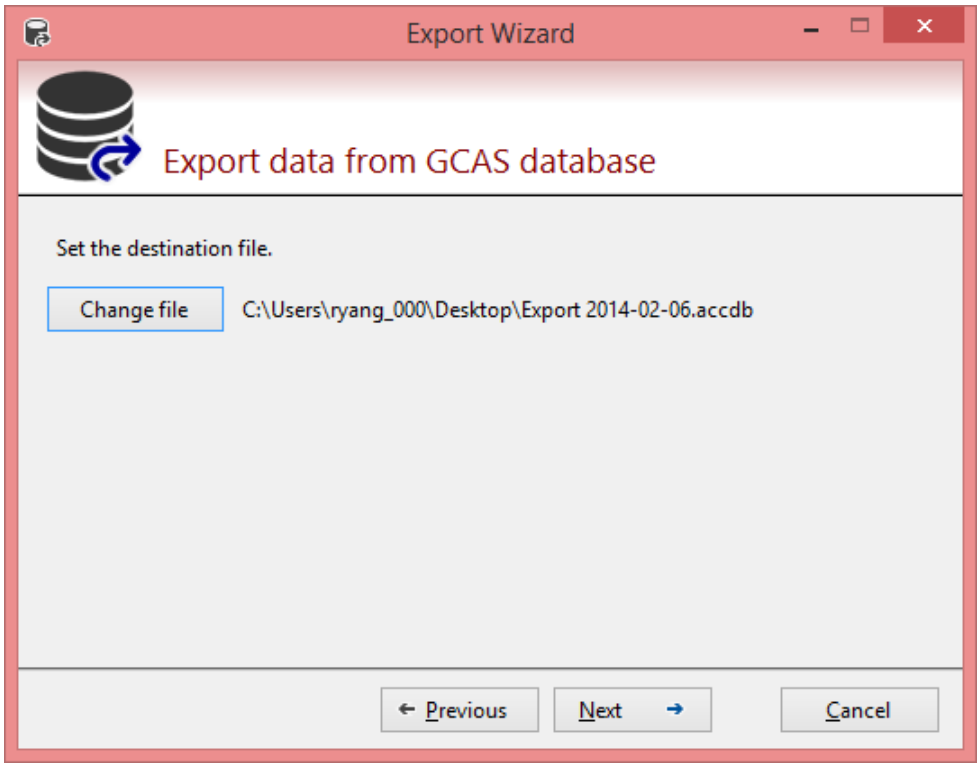
Tick all GC devices you would like to have their data exported.



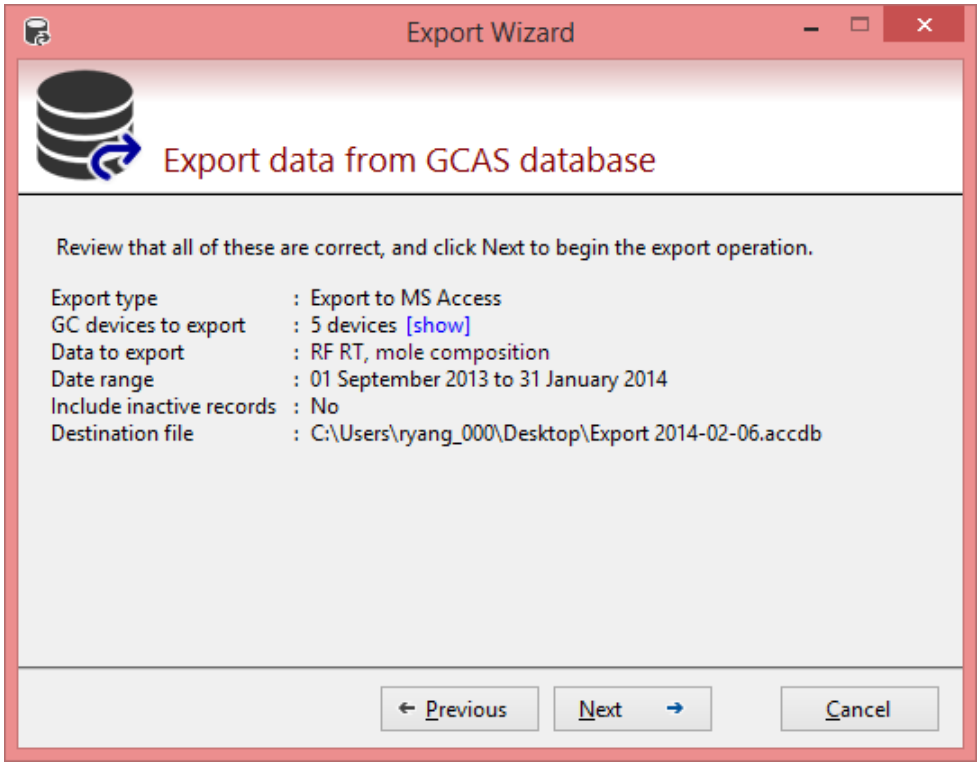
Choose the data kind and a date range to export. If you tick **Also include records marked as inactive**, inactive footprints, calibration data, mole composition data, calibration certificates, uncertainty coefficients, MLC coefficients, and lag time data, including comments for them (if selected) within the defined date range will also be included in the export.



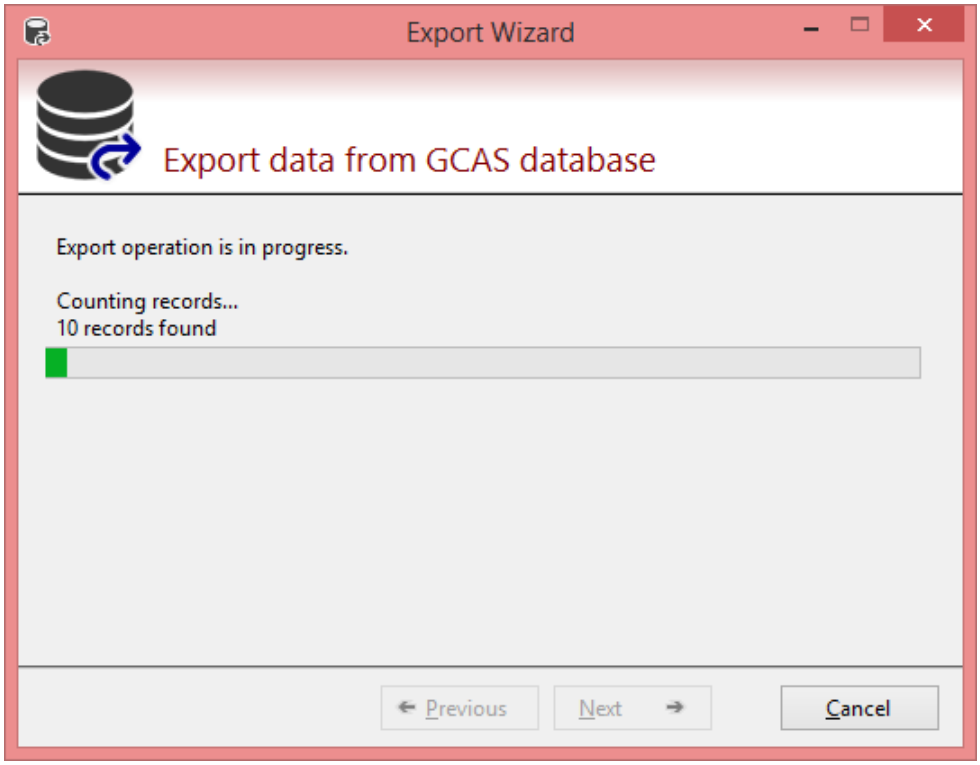
Set the destination Access database file.



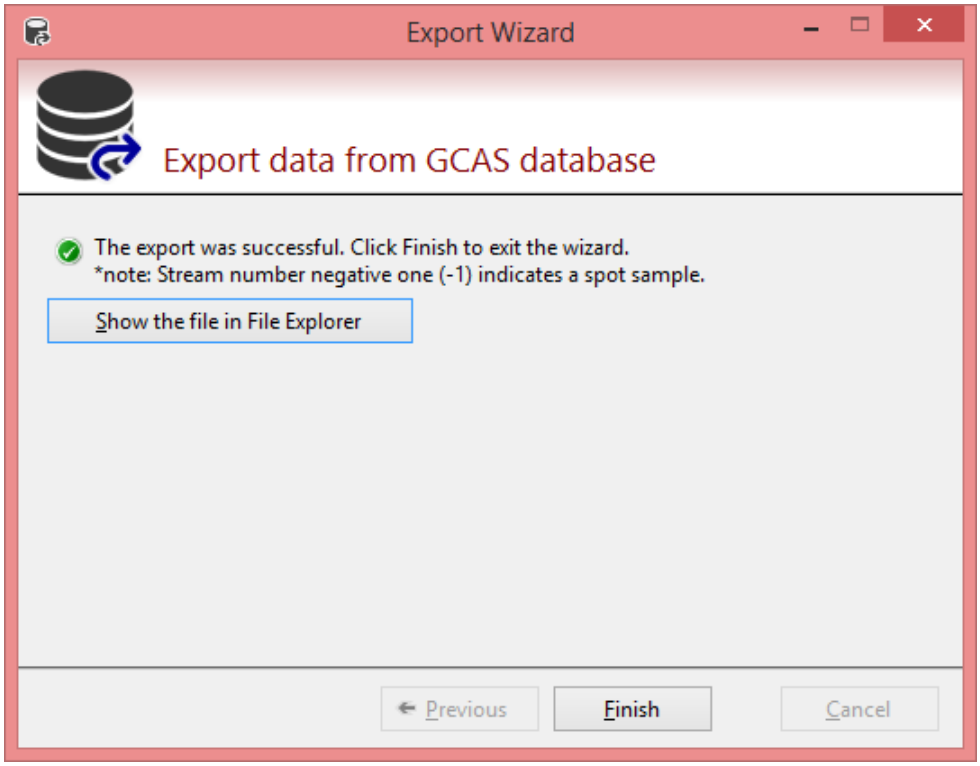
Review the export settings, then click **Next** to begin the export process.


Export Wizard
Export data from GCAS database
Review that all of these are correct, and click Next to begin the export operation.
Export type : Export to MS Access
GC devices to export : 5 devices [show]
Data to export : RF RT, mole composition
Date range : 01 September 2013 to 31 January 2014
Include inactive records : No
Destination file : C:\Users\ryang_000\Desktop\Export 2014-02-06.accdb
Previous
Next
Cancel

GCAS Desktop commences the export operation.

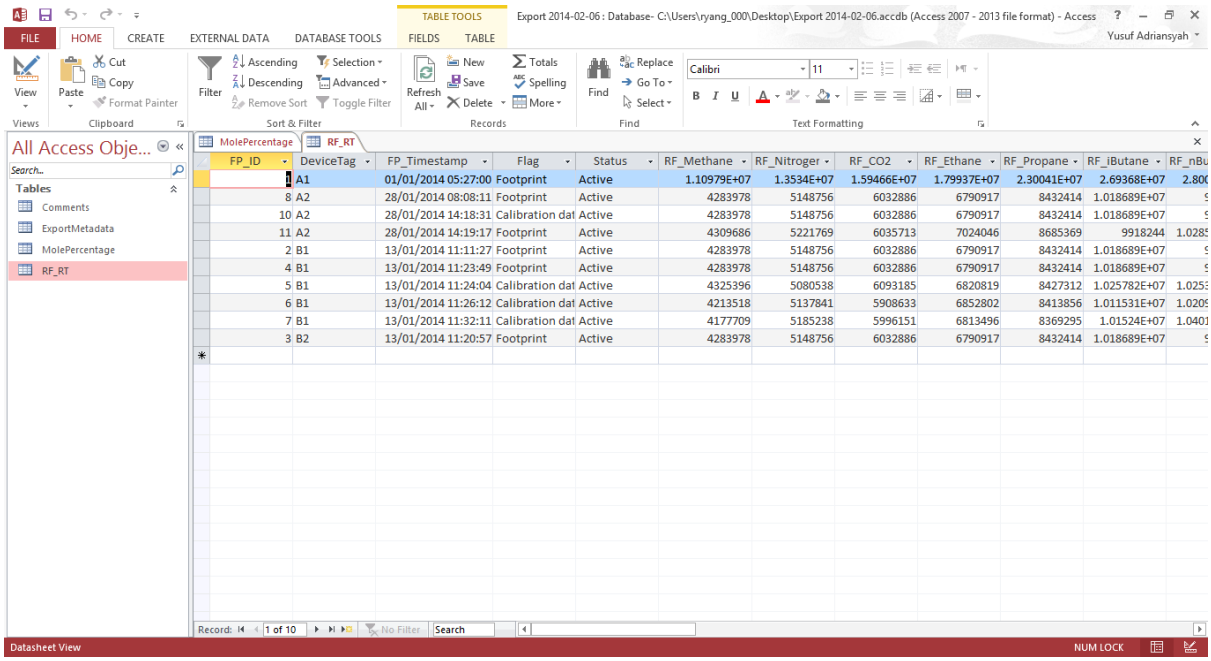


This wizard page confirms that the export has been successful. You can now open the ACCDB file.


Export Wizard
Export data from GCAS database
The export was successful. Click Finish to exit the wizard.
*note: Stream number negative one (-1) indicates a spot sample.
Show the file in File Explorer
Previous
Finish
Cancel

If you chose to export mole composition data and there were spot samples within selected range, these spot samples are represented by stream number negative one (−1) in the Access database.

Here is an example of export result Microsoft Access database file.



Note

If you opted to export uncertainty coefficients or MLC coefficients, the coefficients are stored in two separate tables: *UncertaintyCoefficients* and *UncertaintyCoefficients_Details* for uncertainty, or *MultilevelCoefficients* and *MultilevelCoefficients_Details* for multilevel calibration.

The table *UncertaintyCoefficients* and *MultilevelCoefficients* store the principal metadata of the coefficient sets while *UncertaintyCoefficients_Details* and *MultilevelCoefficients_Detail* table contain the actual coefficients.

You only need to open *UncertaintyCoefficients* table because *UncertaintyCoefficients_Details* is already linked to this table. **Rep** stands for repeatability coefficient, while **Rcc** means response concentration coefficient. Similarly you need to open *MultilevelCoefficients*, not the *_Details* one.

COEFF_ID	DeviceTag	DateOfTest	Status	Description	Click to Add
1	[redacted]	27/08/2014	Active	Data active from 27/8/2014	

DetailsID	GasName	Rep_A	Rep_B	Rep_C	Rep_D	Rcc_A	Rcc_B	Rcc_C	Rcc_D	Click to Add
1	Methane	621180	0	0	0	67861000	9777000	0	0	
2	Nitrogen	33237	5823.1	0	0	207910	13068000	-41238	2336.1	
3	Carbon dioxid	-277.06	13572	0	0	8925.4	15725000	0	0	
4	Ethane	18153	10996	0	0	1750.4	17794000	-34203	0	
5	Propane	4547.4	15521	0	0	-105690	22305000	122260	-18621	
6	i-Butane	3599.7	19235	0	0	-31355	26333000	-271010	0	
7	n-Butane	5931.2	19210	0	0	-64700	27800000	-449000	0	
8	Neopentane	7617.9	0	0	0	-17200	29200000	0	0	
9	i-Pentane	5146.5	14982	0	0	-4400	30000000	0	0	
10	n-Pentane	6434.8	23479	0	0	-16400	31100000	0	0	
11	Hexane	1272.7	24722	0	0	52500	33900000	0	0	
12	Heptane	0	0	0	0	0	0	0	0	
13	Octane	0	0	0	0	0	0	0	0	
14	Nonane	0	0	0	0	0	0	0	0	
15	Decane	0	0	0	0	0	0	0	0	
*	(New)	0	0	0	0	0	0	0	0	

28.4 Export to Microsoft SQL Server Compact Database

This exporter module exports GCAS data to Microsoft SQL Server Compact Edition database file (.sdf). *The export result is a **complete** GCAS database thus you **can** use it as a "local offline" database.*

Note

You need the GCAS feature *Export to Microsoft SQL Server Compact Edition* to be included in your GCAS licence in order to use this feature. Additionally, make sure that Microsoft SQL Server Compact Edition v4.0 has been installed on your computer (it is already a pre-requisite anyway). Otherwise, the Export Wizard will raise an error.

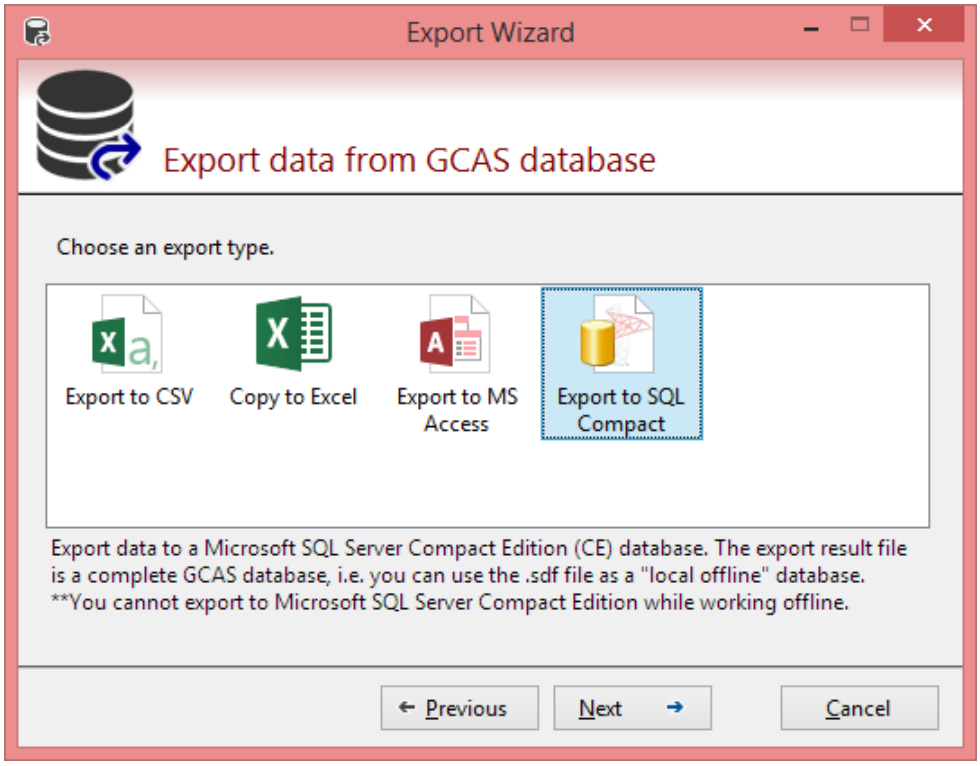
What included in the export result will be:

1. The information about of the selected devices in wizard step 1,
2. The agreement records for these devices,
3. Analysis parameter of these devices,
4. Footprint and calibration data of these devices (if selected in wizard step 2)*,
5. Mole composition data of these devices (if selected in wizard step 2)*,
6. Calibration gas certificates of these devices (if selected in wizard step 2)*,

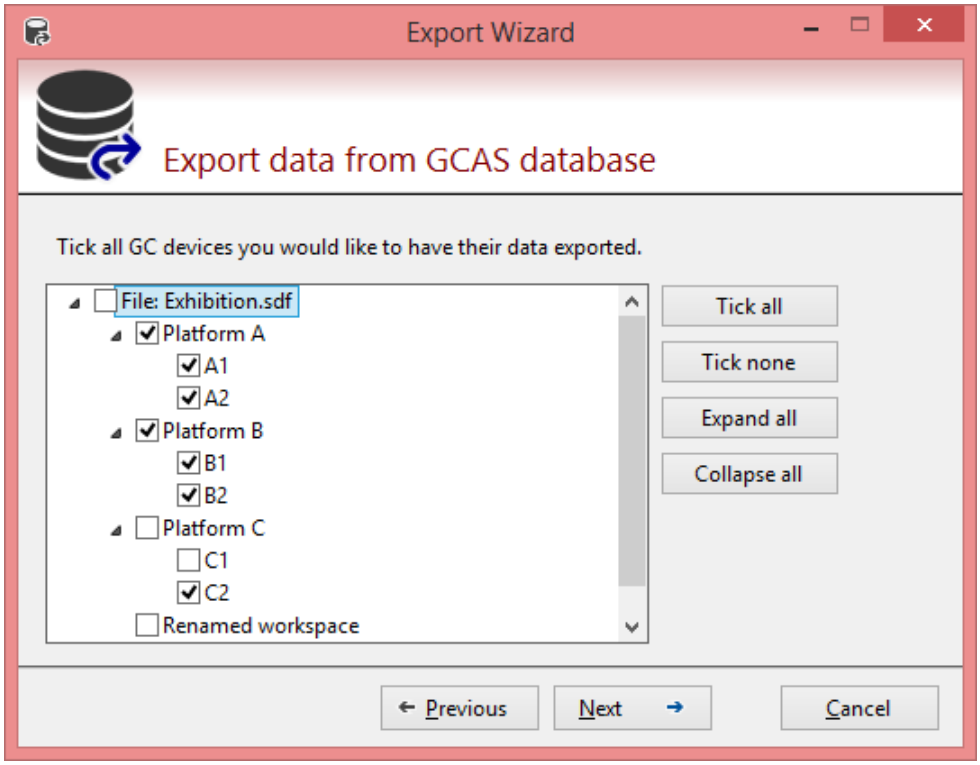
7. Uncertainty coefficients of these devices (if selected in wizard step 2)*,
8. Multilevel calibration coefficients of these devices (if selected in wizard step 2)*,
9. Lag time records of these devices (if selected in wizard step 2)*,
10. Comments for these devices (if selected in wizard step 2)*,
11. The groups to which these devices belong,
12. The workspaces belong to these groups,
13. Login data of all users who joined these groups (yes, they can log in to the exported database file too),
14. User profile data of all users who joined these groups,
15. All user types and roles including custom ones,
16. All menu permissions and action permissions.

*within the selected date range.

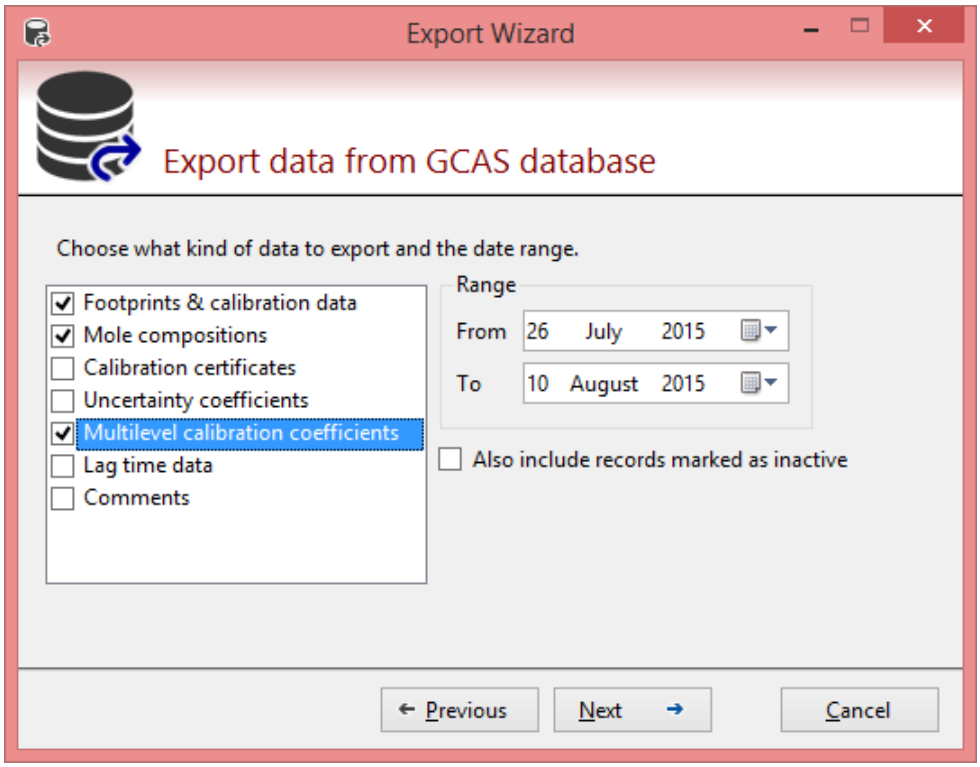
Choose **Export to SQL Compact** to begin. You cannot export to SQL Compact when you are working offline because database structure of full database and temporary database are different.


Export Wizard
Export data from GCAS database
Choose an export type.
Export to CSV
Copy to Excel
Export to MS Access
Export to SQL Compact
Export data to a Microsoft SQL Server Compact Edition (CE) database. The export result file is a complete GCAS database, i.e. you can use the .sdf file as a "local offline" database.
**You cannot export to Microsoft SQL Server Compact Edition while working offline.
Previous
Next
Cancel

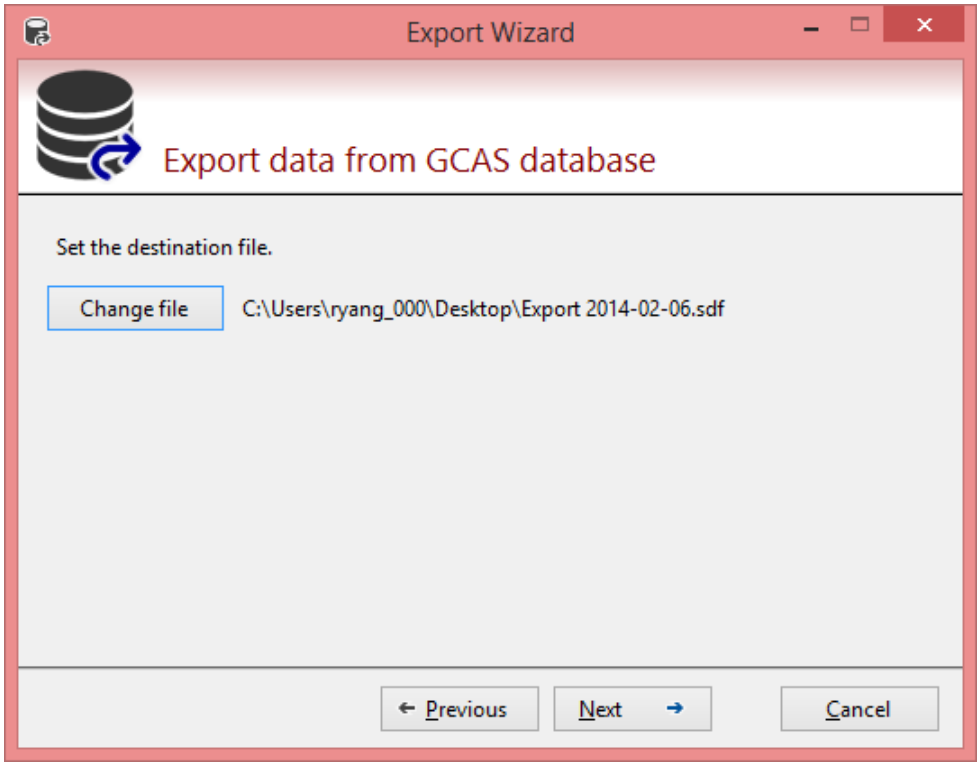
Tick all GC devices you would like to have their data exported.



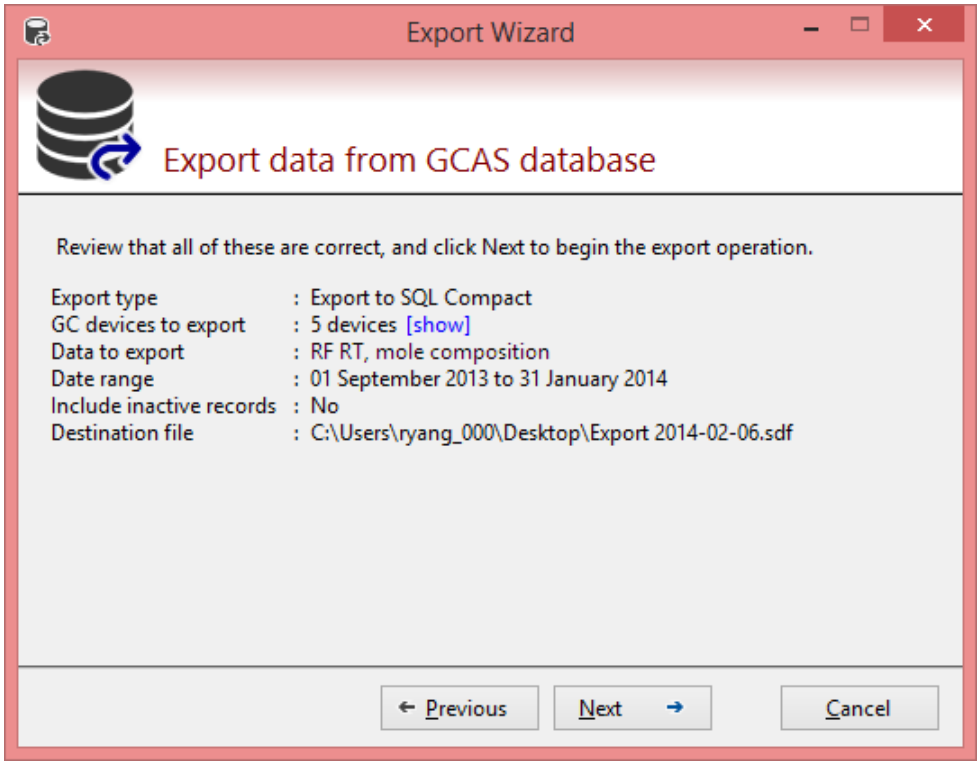
Choose the data kind and a date range to export. If you tick **Also include records marked as inactive**, inactive footprints, calibration data, mole composition data, calibration certificates, uncertainty coefficients, MLC coefficients, and lag time data, including comments for them (if selected) within the defined date range will also be included in the export.



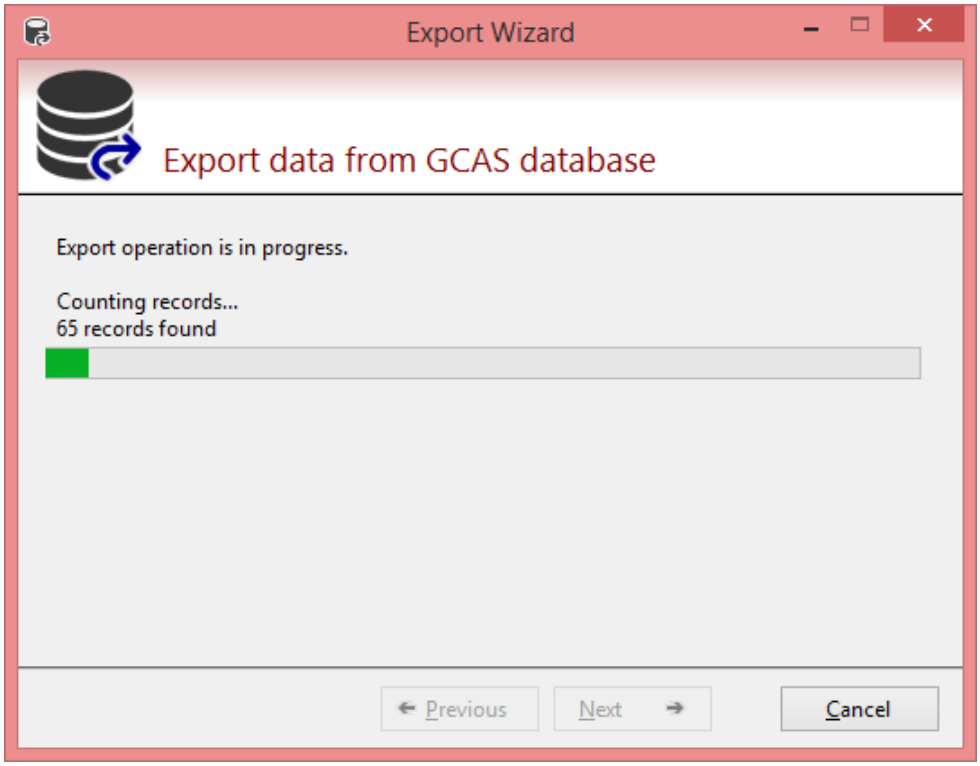
Set the destination database file.



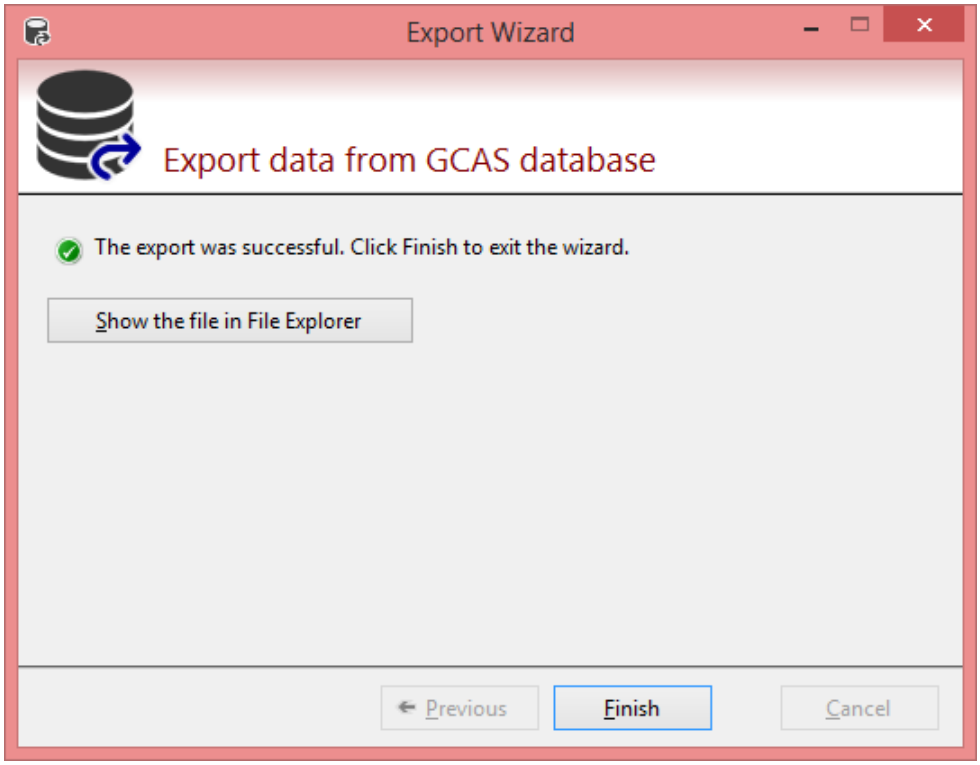
Review the export settings, and click **Next** to begin the export process.


Export Wizard
Export data from GCAS database
Review that all of these are correct, and click Next to begin the export operation.
Export type : Export to SQL Compact
GC devices to export : 5 devices [show]
Data to export : RF RT, mole composition
Date range : 01 September 2013 to 31 January 2014
Include inactive records : No
Destination file : C:\Users\ryang_000\Desktop\Export 2014-02-06.sdf
Previous
Next
Cancel

GCAS Desktop commences the export operation.



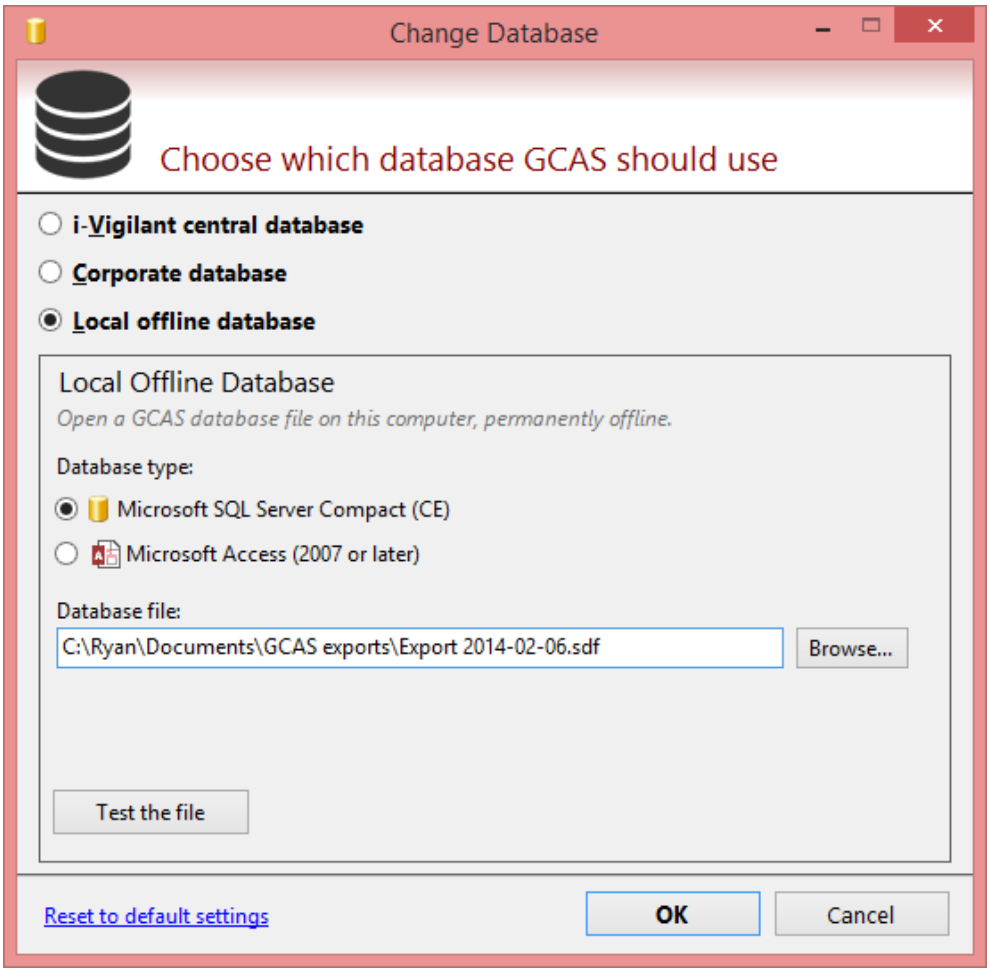
This wizard page confirms that the export has been successful. Click Finish to close the wizard.



In order to verify the export result, try changing database to the SDF file. Use **local offline** option, choose **Microsoft SQL Server Compact** and point to the export file.

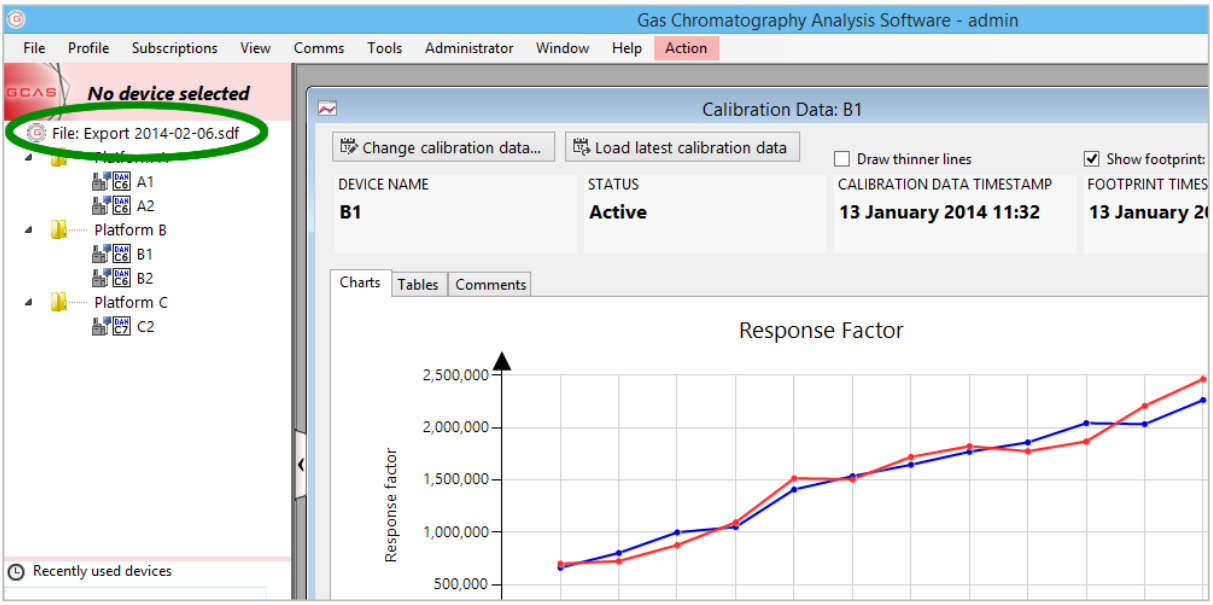
Note

If the option **Local offline database** as in the screenshot below is greyed out, it means you do not have GCAS feature *Local Offline Database* in your GCAS licence.



You should see the file name on your device panel and use GCAS Desktop as usual. However, you would notice several differences:

- This offline database file contains only the devices you have selected in wizard step 1,
- This offline database file contains data for the limited date range you have set in wizard step 2,
- Users who can log in to this offline database file are only *you* and *those who joined the same groups as you*.


Gas Chromatography Analysis Software - admin
File
Profile
Subscriptions
View
Comms
Tools
Administrator
Window
Help
Action
No device selected
File: Export 2014-02-06.sdf
A1
A2
Platform B
B1
B2
Platform C
C2
Recently used devices
Calibration Data: B1
Change calibration data...
Load latest calibration data
Draw thinner lines
Show footprint:
DEVICE NAME
B1
STATUS
Active
CALIBRATION DATA TIMESTAMP
13 January 2014 11:32
FOOTPRINT TIMES
13 January 2
Charts
Tables
Comments
Response Factor
Response factor
2,500,000
2,000,000
1,500,000
1,000,000
500,000

29 Work Offline

GCAS Desktop supports *offline mode* which might be useful in certain scenarios, such as your network connection is disrupted or when you need to take the laptop away to a remote site where internet connection is a luxury. To work offline, you need to set up your own temporary database. GCAS Desktop uses this temporary database while in offline mode.

Note

To use this feature, you need the GCAS feature *Work-offline Capability* to be included in your GCAS licence.

Work-offline is available if your main database server is i-Vigilant central database or your local corporate database. *Offline working is not available for local offline database because it is already offline.*

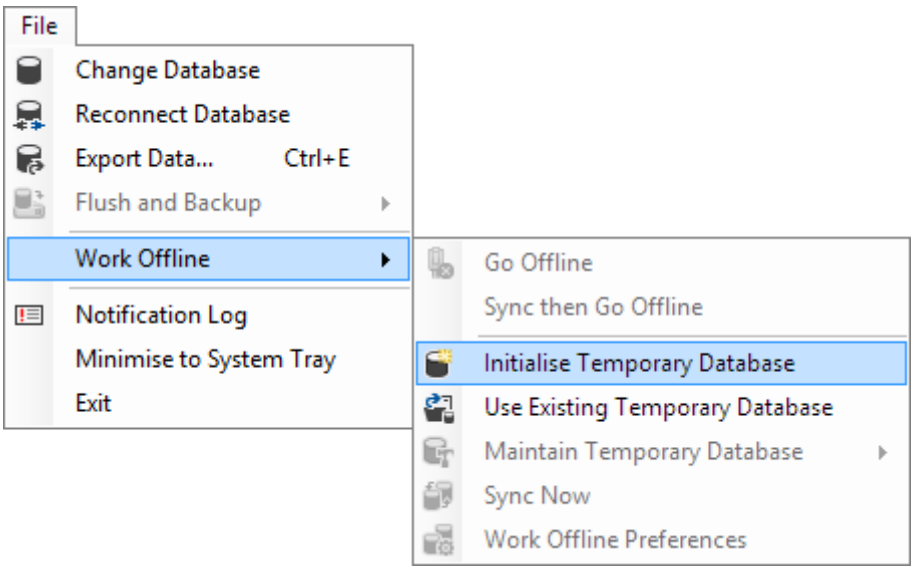
Some features are not available in offline mode. For instance, you cannot change database, edit your profile, edit your password, or use the Administrator menu while working offline.

29.1 Set Up Temporary Database

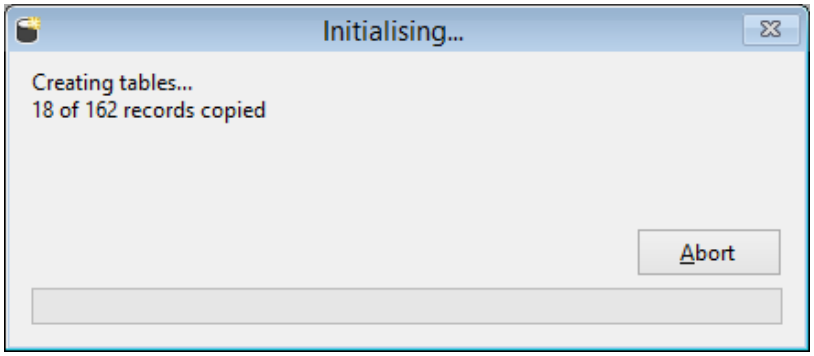
You can either create new temporary database or reuse an existing backup.

29.1.1 Create New Temporary Database

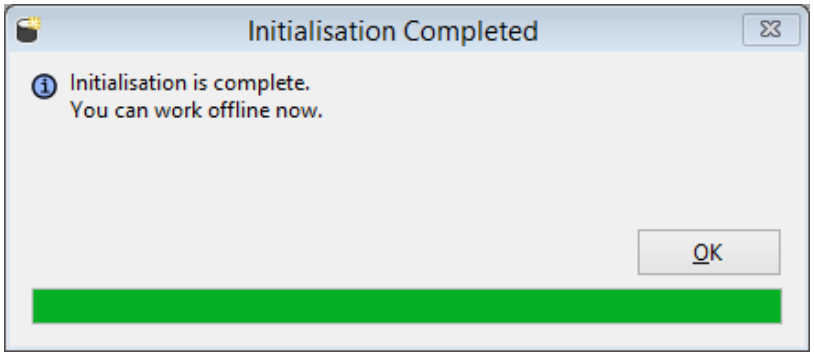
Close all open forms to make sure GCAS Desktop is not performing any operations to the GCAS database. Then, go to the File menu > Work Offline > **Initialise Temporary Database**.



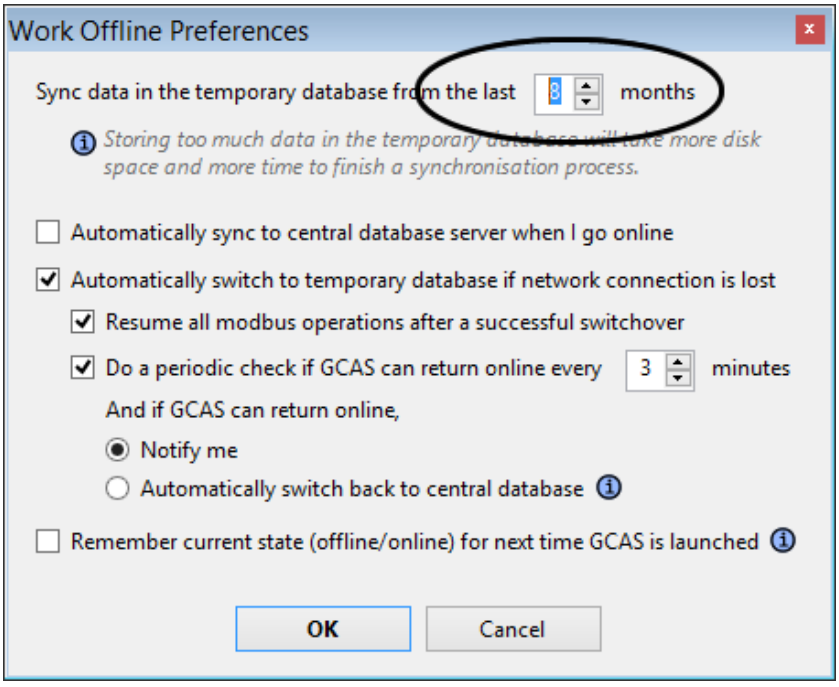
Do not open any forms or dialogue box while initialisation is in progress.



GCAS Desktop creates your temporary database located in the `[installation directory]\DB-WorkOffline\your username.sdf`. GCAS Desktop then synchronises all data from the main database server since last month to your temporary database. That is, all data having timestamp greater than today minus one month. On completion, the progress window displays the confirmation message.

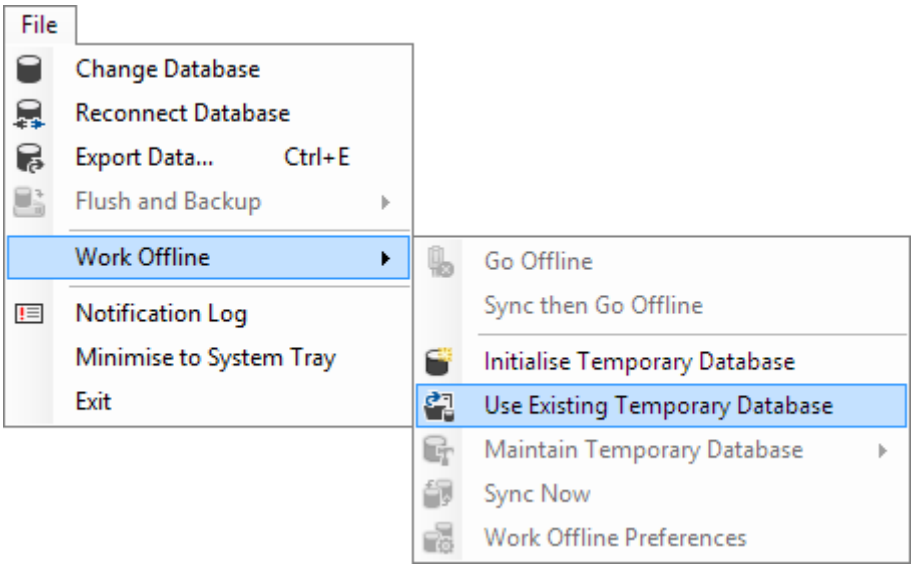


To change how much data to synchronise into temporary database, go to the File menu > Work Offline > **Work Offline Preferences**. Change how many months of data to store on your temporary database between 1 month and 24 months (2 years), then do a manual sync to enforce the change.


Work Offline Preferences
Sync data in the temporary database from the last 3 months
Storing too much data in the temporary database will take more disk space and more time to finish a synchronisation process.
Automatically sync to central database server when I go online
Automatically switch to temporary database if network connection is lost
Resume all modbus operations after a successful switchover
Do a periodic check if GCAS can return online every 3 minutes
And if GCAS can return online,
Notify me
Automatically switch back to central database
Remember current state (offline/online) for next time GCAS is launched
OK
Cancel

29.1.2 Restore a Backup

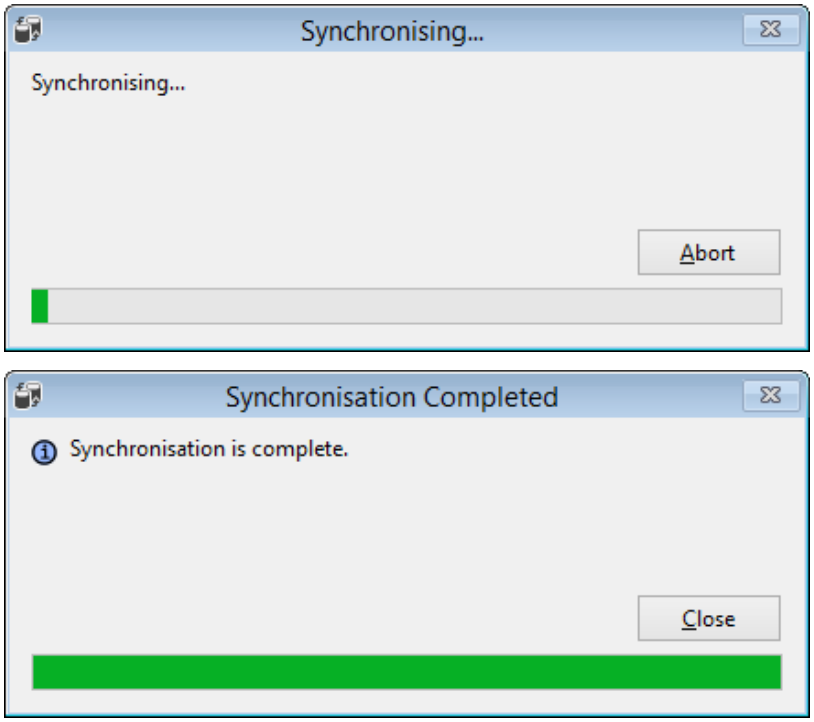
Open the File menu > Work Offline > **Use Existing Temporary Database**. A file dialogue should appear and you can point GCAS Desktop to your backup.



29.2 Synchronise Temporary Database

To initiate a manual sync between your temporary database and your main database server, first you need to work online. Look at the work-offline indicator on the status bar of main user interface, it should display `Online`. If not, follow chapter 29.3 to switch into online mode.

Go to the File menu > Work Offline > **Sync Now**.



Any changes made on the temporary database are committed to the main database server, then your temporary database is refreshed with new data from server. Sync process may take a prolonged time if you have ten thousands of unsynchronised records, especially mole composition data.

Should the progress bar turns red and you see an error message, click on the **Error message** button to see the error log. Or if it turns yellow and you see conflicts, click **Resolve conflicts** to resolve them.

Note

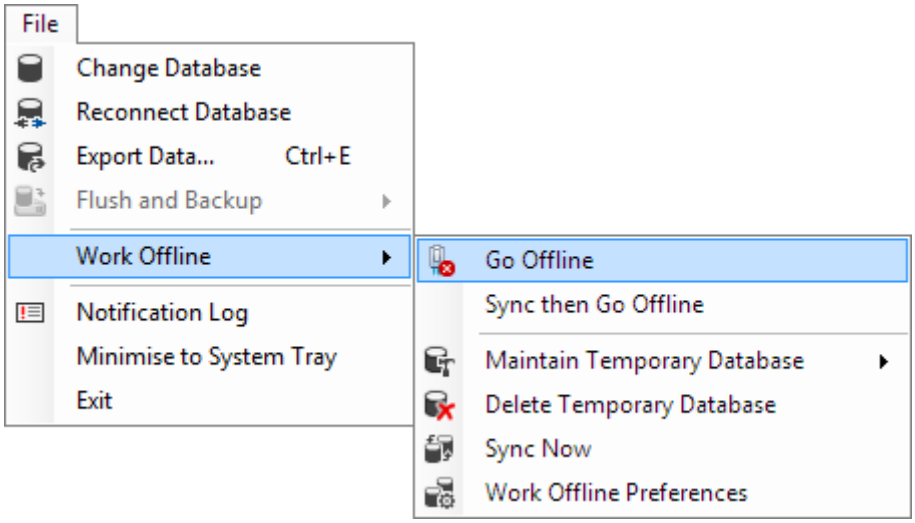
Some cases of *stale condition* bug (the progress bar halts and the computer does nothing) have been reported. Now we introduce stale prevention mechanism. If for any reason you clicked **Abort** in the middle of sync operation, GCAS Desktop tries to stop the sync sequence within 10 seconds. If the operation couldn't abort after 10 seconds, the form displays the **Force abort** button. Use this button to terminate background threads immediately.

29.3 Going Offline, Going Online

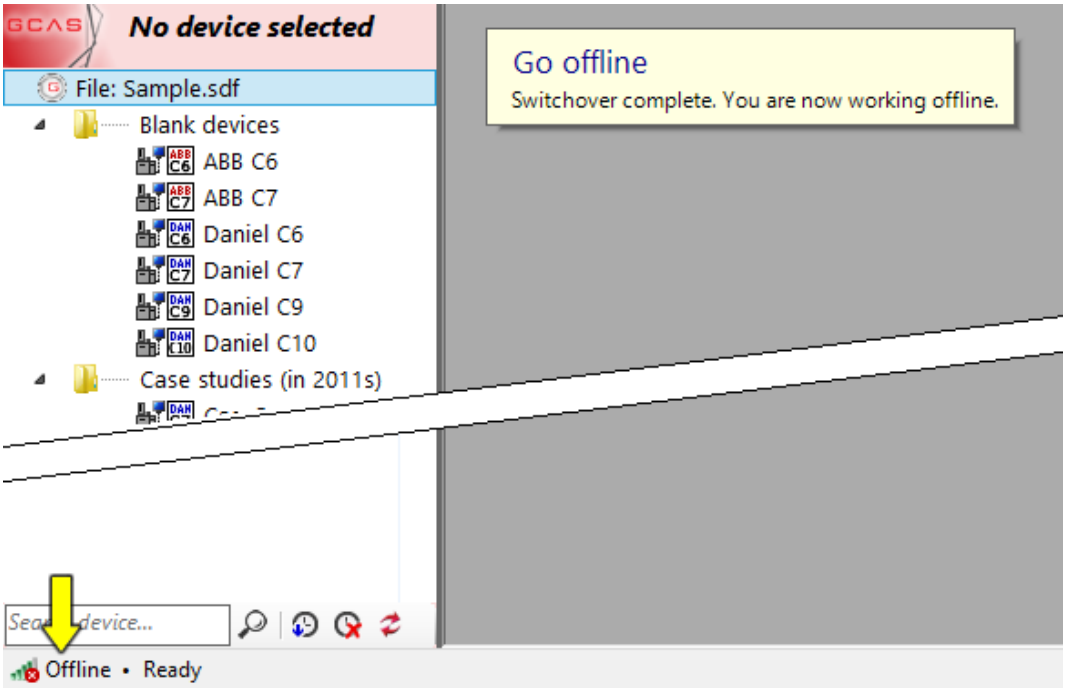
Manual switch between online and offline mode requires all open forms to be closed. This is to make sure that GCAS Desktop is not doing any operation on GCAS database.

Switch into offline mode: Go to the File menu > Work Offline > **Go Offline** to switch immediately.

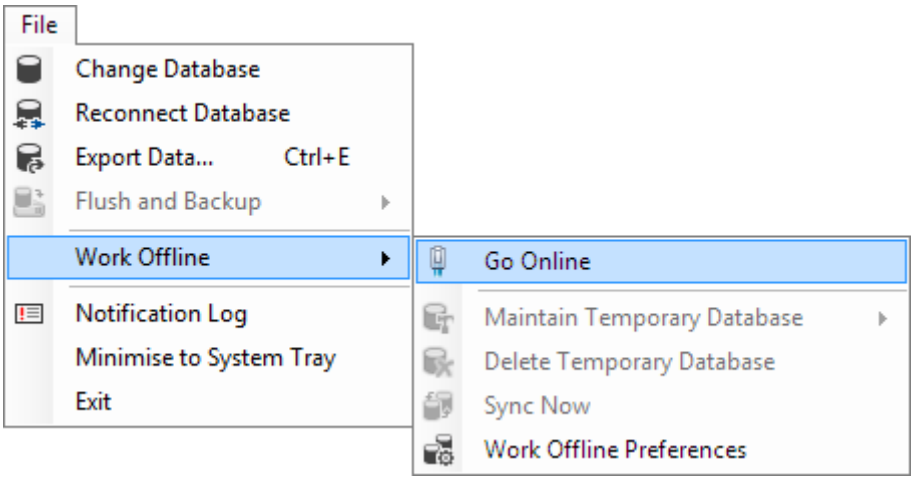
Alternatively, choose the second menu (**Sync then Go Offline**). The second menu will initiate a sync and afterwards switches GCAS Desktop to offline mode.



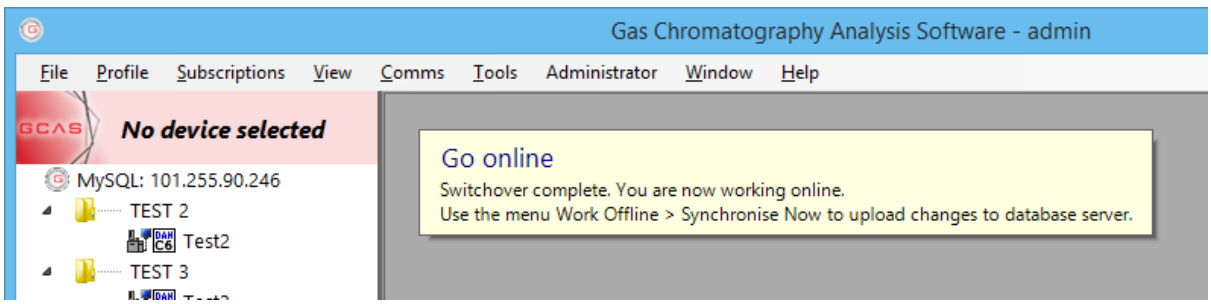
On successful switchover, the work-offline indicator displays "`Offline`" and there will be a notification that you are now working offline.



Switch into online mode: Similarly, go to the File menu > Work Offline > **Go Online**.

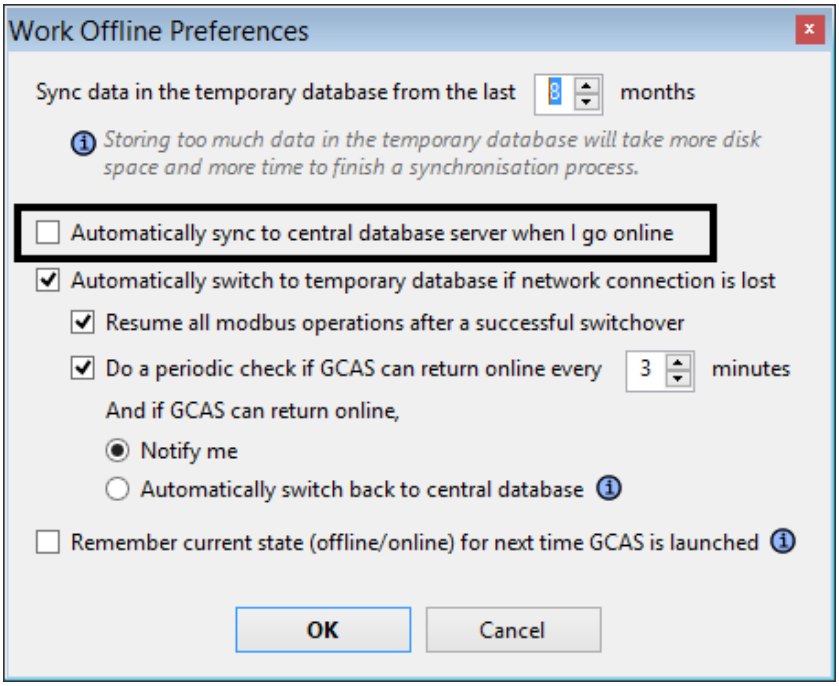


On successful switchover, the work-offline indicator on the status bar displays "`Online`" and also there will be a notification that you are now working online. If automatic sync on switchover is turned on, GCAS Desktop initiates a database sync automatically.


Gas Chromatography Analysis Software - admin
File Profile Subscriptions View Comms Tools Administrator Window Help
No device selected
MySQL: 101.255.90.246
TEST 2
Test2
TEST 3
Go online
Switchover complete. You are now working online.
Use the menu Work Offline > Synchronise Now to upload changes to database server.

29.4 Automatic Sync when Returning Online

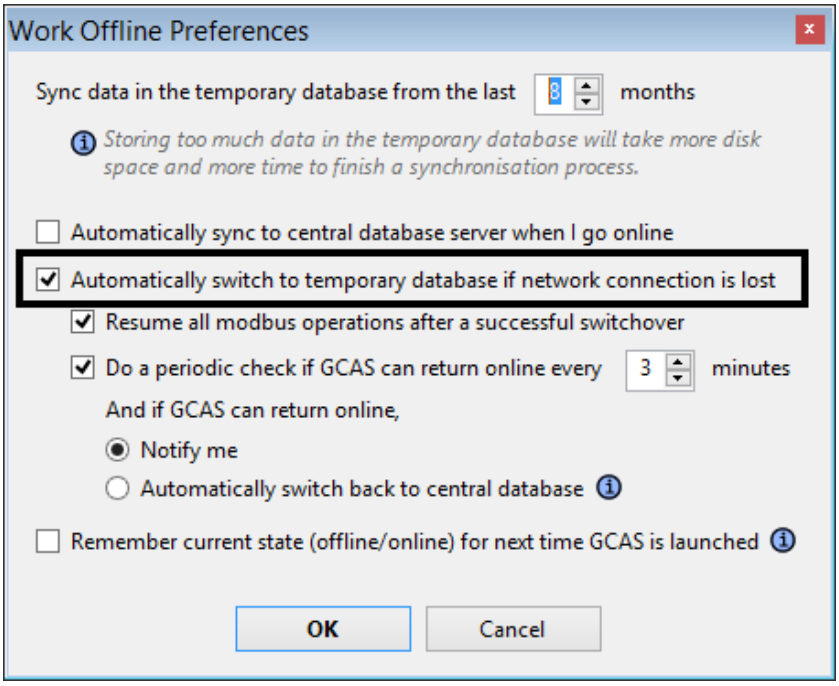
GCAS Desktop can start an automatic database sync when you go online. To enable this feature, open the *Work Offline Preferences* dialogue by opening the File menu > Work Offline > **Work Offline Preferences**.


Work Offline Preferences
Sync data in the temporary database from the last 8 months
Storing too much data in the temporary database will take more disk space and more time to finish a synchronisation process.
Automatically sync to central database server when I go online
Automatically switch to temporary database if network connection is lost
Resume all modbus operations after a successful switchover
Do a periodic check if GCAS can return online every 3 minutes
And if GCAS can return online,
Notify me
Automatically switch back to central database
Remember current state (offline/online) for next time GCAS is launched
OK
Cancel

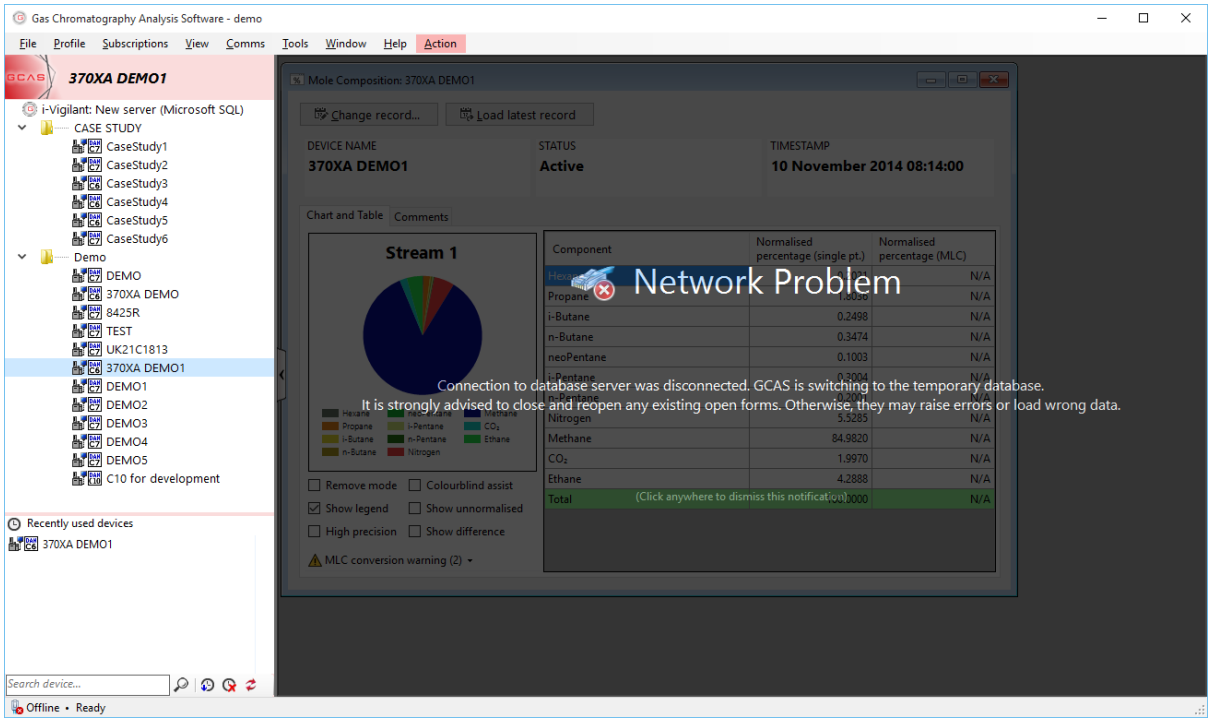
Tick **Automatically sync to central/online database server when I go online** to turn on this feature. Next time you work offline and is about to switch into online mode, GCAS Desktop synchronise the temporary database and the main database server as soon as it enters online mode.

29.5 Automatic Switchover on Network Problem

GCAS Desktop switches to your temporary database if the network connection between your computer and GCAS database server gets interrupted. To enable this feature, open *Work Offline Preferences* through the File menu > Work Offline > **Work Offline Preferences**. Give a tick mark on **Automatically switch to temporary database if network connection is lost**.

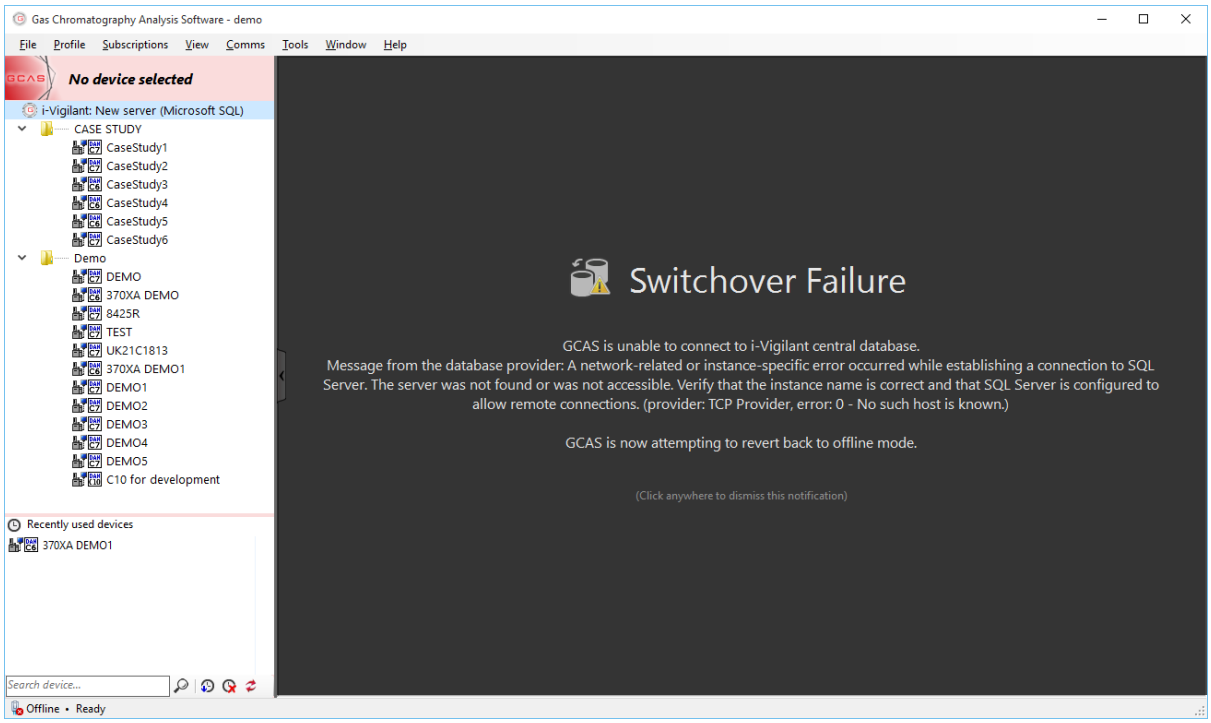

Work Offline Preferences
Sync data in the temporary database from the last 8 months
Storing too much data in the temporary database will take more disk space and more time to finish a synchronisation process.
Automatically sync to central database server when I go online
Automatically switch to temporary database if network connection is lost
Resume all modbus operations after a successful switchover
Do a periodic check if GCAS can return online every 3 minutes
And if GCAS can return online,
Notify me
Automatically switch back to central database
Remember current state (offline/online) for next time GCAS is launched
OK
Cancel

In case of network disturbance, GCAS Desktop displays an overlay notification telling you that GCAS has switched to offline mode. Click anywhere on the overlay to dismiss the notification.


Gas Chromatography Analysis Software - demo
Network Problem
Connection to database server was disconnected. GCAS is switching to the temporary database.
It is strongly advised to close and reopen any existing open forms. Otherwise, they may raise errors or load wrong data.
(Click anywhere to dismiss this notification)
370XA DEMO1
Stream 1
Offline • Ready

We strongly recommend to close and reopen all open forms. This is because each form retains a connection to GCAS database server but the disruption cut this connection. Attempting to continue working on open forms may raise an error especially when there is a task to load or reload data from the database.

Please do not attempt to go back online should your network connection had not recovered. Attempting to do so would make GCAS Desktop tries to connect to your main database server, finds it failing, and switches back to your temporary database.

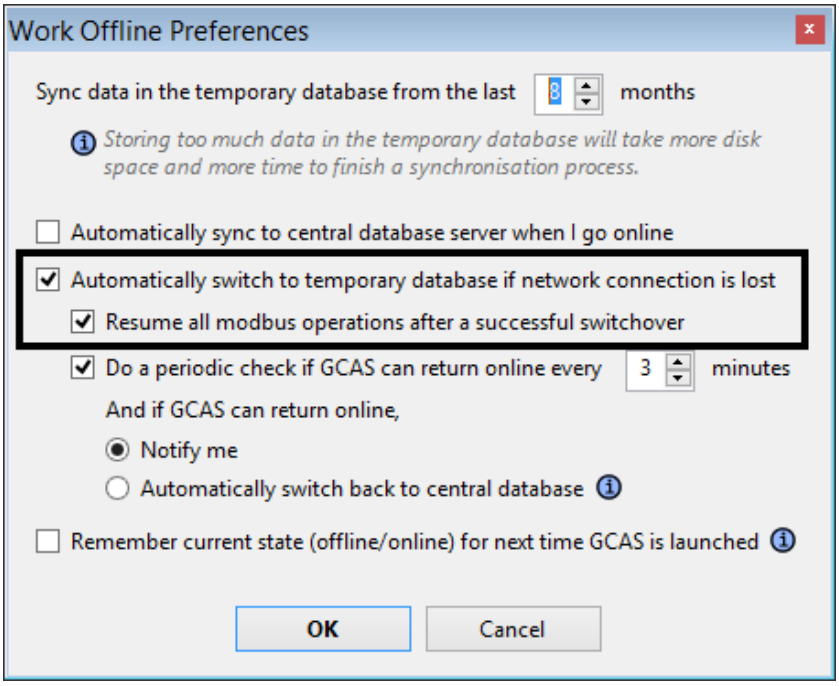

Gas Chromatography Analysis Software - demo
File Profile Subscriptions View Comms Tools Window Help
No device selected
i-Vigilant: New server (Microsoft SQL)
CASE STUDY
CaseStudy1
CaseStudy2
CaseStudy3
CaseStudy4
CaseStudy5
CaseStudy6
Demo
DEMO
370XA DEMO
8425R
TEST
UK21C1813
370XA DEMO1
DEMO1
DEMO2
DEMO3
DEMO4
DEMO5
C10 for development
Recently used devices
370XA DEMO1
Search device...
Offline • Ready
Switchover Failure
GCAS is unable to connect to i-Vigilant central database.
Message from the database provider: A network-related or instance-specific error occurred while establishing a connection to SQL Server. The server was not found or was not accessible. Verify that the instance name is correct and that SQL Server is configured to allow remote connections. (provider: TCP Provider, error: 0 - No such host is known.)
GCAS is now attempting to revert back to offline mode.
(Click anywhere to dismiss this notification)

29.6 Automatic Resumption of Data Capture

GCAS Desktop stops all data capture operations immediately after it detects network connectivity problem. This is because the connection between GC Connect form and GCAS database server was cut during this disruption, thus an attempt to commit an incoming new record to database server would yield an error.

If you don't have GCAS feature *Work-offline Capability* in your GCAS licence, or if you never set up a temporary database beforehand, all GC Connect forms remain stopped after the disruption. This is particularly bad if you used unattended mode, as no one knows that the operation terminated until someone visits the computer.

With work-offline capability, GCAS Desktop can safely resume all data capture operations after switching to temporary database. To enable this feature, open *Work Offline Preferences* dialogue through the File menu > Work Offline > **Work Offline Preferences**.


Work Offline Preferences
Sync data in the temporary database from the last 8 months
Storing too much data in the temporary database will take more disk space and more time to finish a synchronisation process.
Automatically sync to central database server when I go online
Automatically switch to temporary database if network connection is lost
Resume all modbus operations after a successful switchover
Do a periodic check if GCAS can return online every 3 minutes
And if GCAS can return online,
Notify me
Automatically switch back to central database
Remember current state (offline/online) for next time GCAS is launched
OK
Cancel

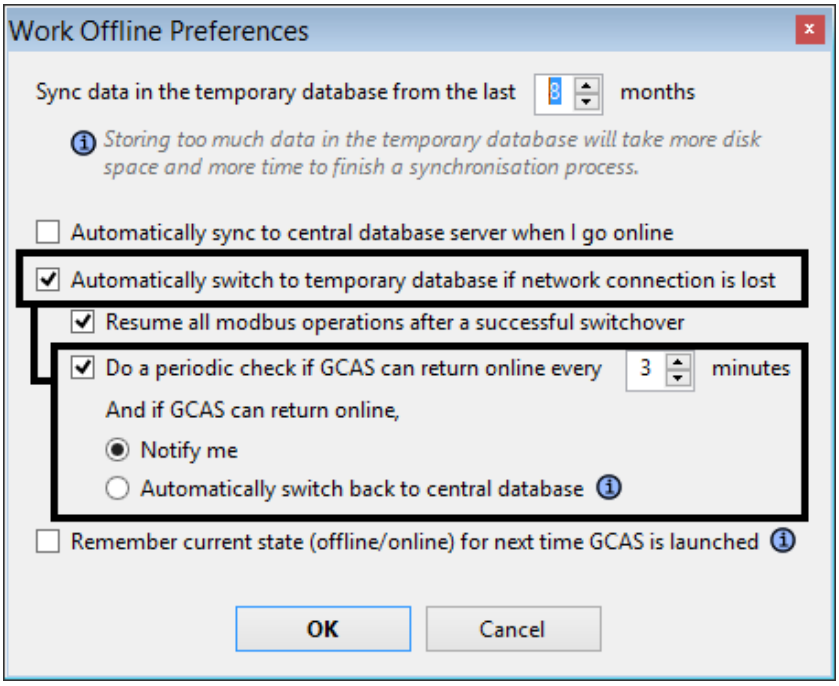
First, automatic switch on network problem must be checked. Then, give a check mark on **Resume all Modbus operations after a successful switchover**. Through this way, all unattended data capture operations stop temporarily and continue soon after GCAS Desktop enters offline mode. Records committed before network disruption are still available on your main database server but records committed after network disruption will be stored on your temporary database. You can synchronise records between these two databases later after the network connectivity is up again.

29.7 Automatic Detection of Online Connectivity

After all the fuss of automatic switchover on network problem, GCAS Desktop may ping the database server from time to time in order to see if you can return online. To activate this feature, open *Work Offline Preferences* dialogue through the File menu > Work Offline > **Work Offline Preferences**.

Note

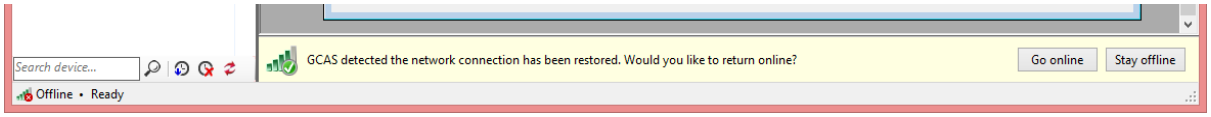
This feature works only for offline mode caused by network disruption. GCAS Desktop will *never* ping the database server if you *intentionally* switched into offline mode as described in chapter 29.3 Going Offline.


Work Offline Preferences
Sync data in the temporary database from the last 8 months
Storing too much data in the temporary database will take more disk space and more time to finish a synchronisation process.
Automatically sync to central database server when I go online
Automatically switch to temporary database if network connection is lost
Resume all modbus operations after a successful switchover
Do a periodic check if GCAS can return online every 3 minutes
And if GCAS can return online,
Notify me
Automatically switch back to central database
Remember current state (offline/online) for next time GCAS is launched
OK
Cancel

First, automatic switch on network problem must be checked. Next, tick **Do a periodic check if GCAS can return online** and set the desired interval. You can choose ping interval from every single minute to every one hour.

And if GCAS Desktop can return online, choose one of the available sub options.

a. **Notify me**: GCAS displays a panel notification at the bottom of the main user interface saying you can return online. Pick the appropriate decision whether to go online or stay offline.


Search device...
GCAS detected the network connection has been restored. Would you like to return online?
Go online
Stay offline
Offline • Ready

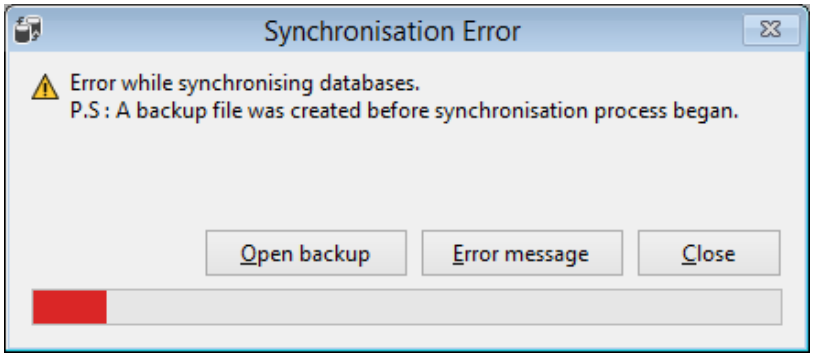
As a reminder, when you choose to go online, make sure that all open forms have been closed. You can reopen these forms later after the switchover.

b. **Automatically switch back to central/online database**: GCAS performs another automatic switchover to online mode when possible. This is particularly useful for unattended data capture.

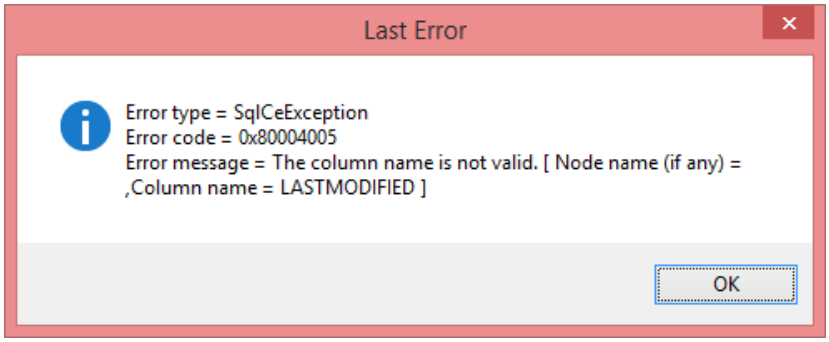
If you choose this option, all data capture operations will once again be stopped during the switchover. Tick **Resume all Modbus operations after a successful switchover** to make GCAS Desktop resumes all data capture operations after entering online mode. Special case if you also enabled automatic sync when returning online, the sequence is temporary database sync comes first then data capture resumption takes place afterwards.

29.8 Sync Error Log

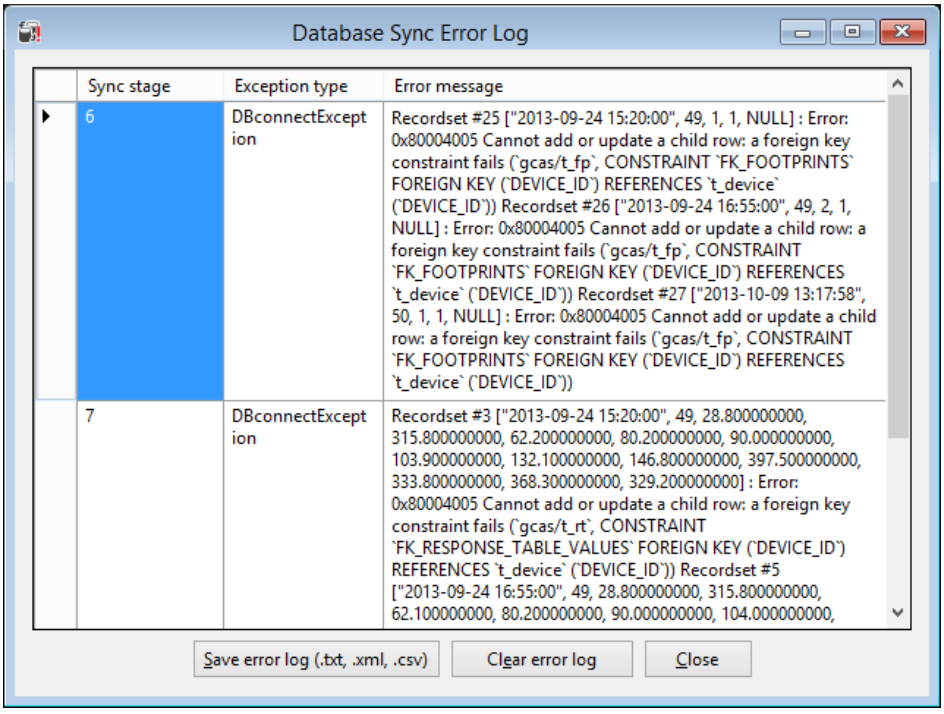
During a database sync, the process may stop when GCAS Desktop encounters errors. Red progress bar indicates serious errors, while yellow progress bar indicates less severe errors. Click the **Error message** button to see more details about the error.



Error messages can be as simple (yet fatal) as one message box like this one...


Last Error
Error type = SqlCeException
Error code = 0x80004005
Error message = The column name is not valid. [Node name (if any) =
,Column name = LASTMODIFIED]
OK

...or more complicated that the errors are displayed in a dedicated window.


Database Sync Error Log
Sync stage
Exception type
Error message
6
DBconnectException
Recordset #25 ["2013-09-24 15:20:00", 49, 1, 1, NULL] : Error: 0x80004005 Cannot add or update a child row: a foreign key constraint fails (`gcas/t_fp`, CONSTRAINT `FK_FOOTPRINTS` FOREIGN KEY (`DEVICE_ID`) REFERENCES `t_device` (`DEVICE_ID`)) Recordset #26 ["2013-09-24 16:55:00", 49, 2, 1, NULL] : Error: 0x80004005 Cannot add or update a child row: a foreign key constraint fails (`gcas/t_fp`, CONSTRAINT `FK_FOOTPRINTS` FOREIGN KEY (`DEVICE_ID`) REFERENCES `t_device` (`DEVICE_ID`)) Recordset #27 ["2013-10-09 13:17:58", 50, 1, 1, NULL] : Error: 0x80004005 Cannot add or update a child row: a foreign key constraint fails (`gcas/t_fp`, CONSTRAINT `FK_FOOTPRINTS` FOREIGN KEY (`DEVICE_ID`) REFERENCES `t_device` (`DEVICE_ID`))
7
DBconnectException
Recordset #3 ["2013-09-24 15:20:00", 49, 28.800000000, 315.800000000, 62.200000000, 80.200000000, 90.000000000, 103.900000000, 132.100000000, 146.800000000, 397.500000000, 333.800000000, 368.300000000, 329.200000000] : Error: 0x80004005 Cannot add or update a child row: a foreign key constraint fails (`gcas/t_rt`, CONSTRAINT `FK_RESPONSE_TABLE_VALUES` FOREIGN KEY (`DEVICE_ID`) REFERENCES `t_device` (`DEVICE_ID`)) Recordset #5 ["2013-09-24 16:55:00", 49, 28.800000000, 315.800000000, 62.100000000, 80.200000000, 90.000000000, 104.000000000,
Save error log (.txt, .xml, .csv)
Clear error log
Close

These kinds of error are usually related to database. For example, the message in first example "**`Column name is not valid`**" means the database structure is incomplete. This indicates the file `[installation directory]\DB-Template\WorkOffline.sdf` is corrupt (or outdated) and you need to upgrade the GCAS database file. In the second example, "**`Cannot add or update a child row: a foreign key constrain fails`**" means there are some records missing in another table inside the database, but GCAS needs these records in order to write current record.

If you use i-Vigilant central database and see Database Sync Error Log such as in the second example, click **Save error log** button and send the file to our support team so that we can look for the cause of error. If you use local corporate database, your database administrator (DBA) might help you solve the problem.

GCAS Desktop tries to create a backup file of your temporary database before sync process begins. You can find the backup in the same directory as your temporary database. Some scenarios might prevent GCAS Desktop to create this backup though, such as if your hard disk is full. The file resides on `[installation directory]\DB-WorkOffline\your username.sdf.backup`. Should these sync errors render your temporary database unusable, follow these steps.

1. Go online and cancel automatic sync (if any; by pressing the **Abort** button).
2. Open the File Explorer ("Windows Explorer" on Windows Vista and 7) and navigate to `[installation directory]\DB-WorkOffline\` directory.
3. Delete your temporary database (`your username.sdf`)
4. Rename `your username.sdf.backup` into `your username.sdf`

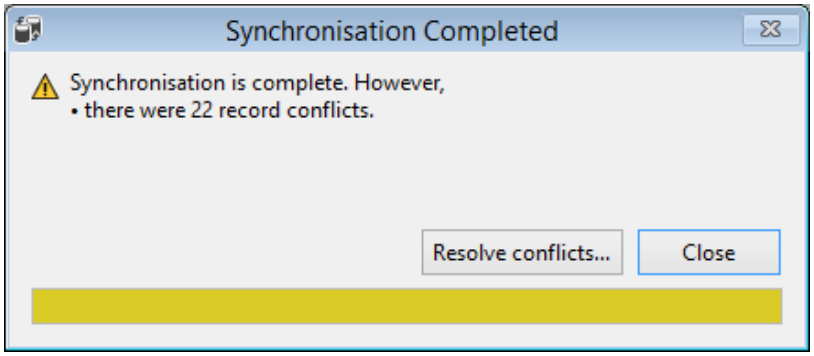
A better solution is available if you have ever made a proper backup of your temporary database.

1. Copy your current temporary database file to somewhere else.
2. Go online and stop any automatic sync by pressing the **Abort** button.
3. Open the File menu > Work Offline > Delete Temporary Database. This will delete the problematic temp database file.
4. Open the File menu > Work Offline > Use Existing Temporary Database.
5. Point to your backup .sdf file.
6. Do a manual sync to refresh the temporary database file.

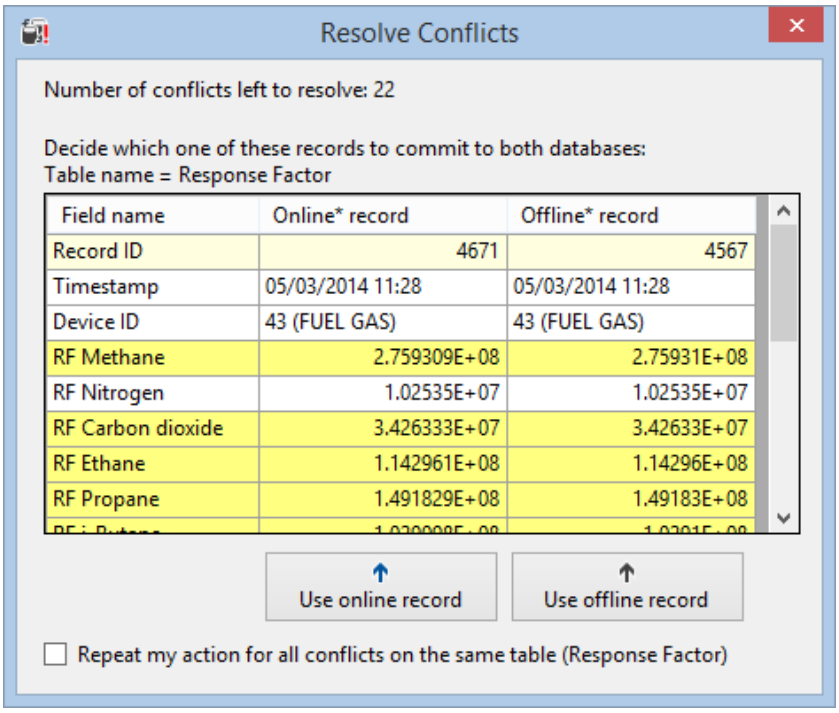
Should all the steps above did not provide remedy to the problem, you might need to delete your temporary database and recreate a new one. You may lose data which has not been synchronised to the main database server.

29.9 Conflict Resolution

A *conflict* is a mismatch between database record on your main database server and the corresponding record on your temporary database so that GCAS Desktop cannot determine which one to keep. GCAS Desktop keeps track of when a record was changed and uses this information to determine which one is the most recent. When a conflict happens, this last-modified information is either equal (meaning that both records were updated at the same time) or unavailable. The probability you would find a record conflict is quite rare, nevertheless a slim chance is not zero chance.



When conflicts arise, the sync progress bar turns yellow. Click **Resolve conflicts** to see what records are conflicting. The button brings the *Resolve Conflicts* dialogue similar to the screenshot below. Conflicting fields are highlighted in yellow.


Resolve Conflicts
Number of conflicts left to resolve: 22
Decide which one of these records to commit to both databases:
Table name = Response Factor
Field name
Online* record
Offline* record
Record ID 4671 4567
Timestamp 05/03/2014 11:28 05/03/2014 11:28
Device ID 43 (FUEL GAS) 43 (FUEL GAS)
RF Methane 2.759309E+08 2.75931E+08
RF Nitrogen 1.02535E+07 1.02535E+07
RF Carbon dioxide 3.426333E+07 3.42633E+07
RF Ethane 1.142961E+08 1.14296E+08
RF Propane 1.491829E+08 1.49183E+08
Use online record
Use offline record
Repeat my action for all conflicts on the same table (Response Factor)

To resolve one conflict, click the appropriate button whether to **Use online record** or **Use offline record**. Using online record wins the record on your main database server and replaces the conflicting record on your temporary database. On the opposite side, using offline record wins the record on your temporary database and replaces the offending record on your main database server.

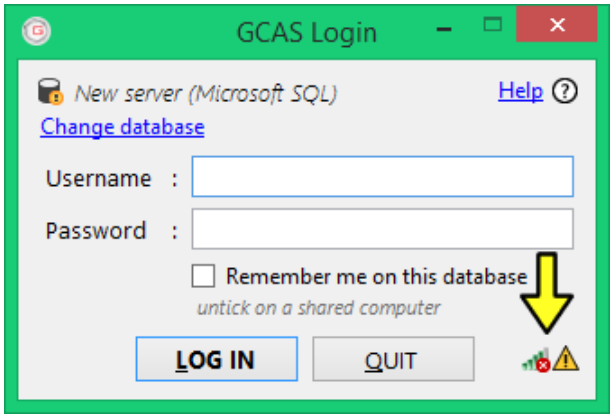
Once you clicked the appropriate button, GCAS Desktop applies change to both databases and moves on to the next conflict if any. To repeat your action whether using online record or offline record for a particular database table, first tick **Repeat my action for all conflicts on the same table** and then click the appropriate decision whether to **Use online record** or **Use offline record**. GCAS Desktop applies the same action for all conflicts on the same database table in the queue. Eventually GCAS Desktop may load a conflict of a different database table; GCAS Desktop will display both records and ask you to review and decide an action again. At the end, when all the conflicts have been resolved, the dialogue closes automatically.

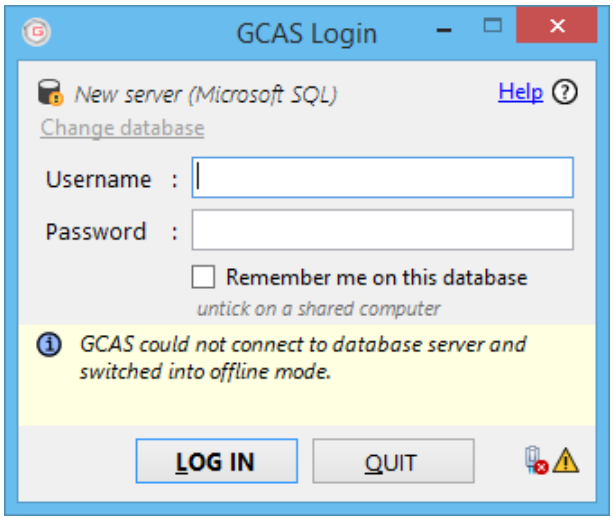
Note

To leave all conflicts as they are, i.e. to let the records be different between your main database and your temporary database, close the *Resolve Conflicts* dialogue using the close (×) button on the title bar. GCAS Desktop will ask you to resolve them later upon next sync operation.

29.10 Login Form in Offline Mode

When you are working offline, you can also log out from GCAS as usual (or be automatically logged out for inactivity). However please notice that the login form is in *offline mode* now. A warning icon appears on the right side of Quit button.



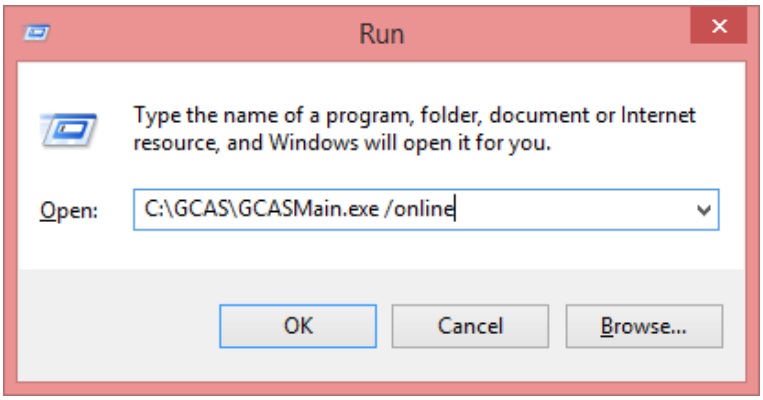


During offline mode, only users who already set up their temporary databases can log in.

Login form in offline mode behaves differently compared to normal (online) mode. As in online mode, GCAS Desktop is continuously connected to GCAS database server so that any login attempt is immediately verified against user credential in the database server. However in offline mode, the login form first checks if the user has his temporary database available, then verifies the login attempt against credential stored inside his temporary database. This is why users without temporary databases (i.e. never set them up before) cannot log in to GCAS.

In an unfortunate scenario where you have never set up your temporary database, you would not be able to log in during offline mode. You can force GCAS to return online and here are the steps to do so.

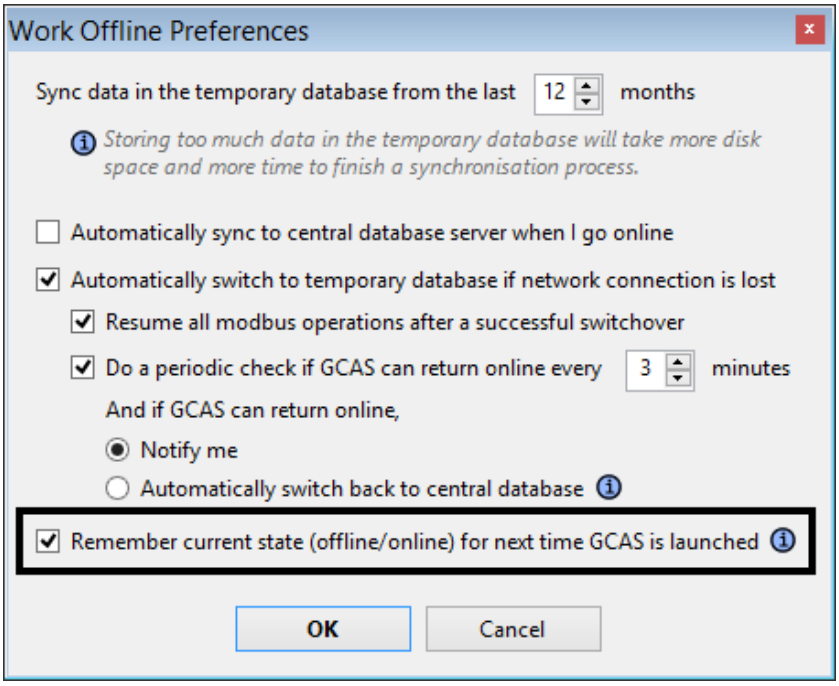
1. Verify that your network or internet connection is working.
2. Exit GCAS Desktop through the **Quit** button on the login form.
3. Run GCAS Desktop with an additional **/online** parameter.
4. GCAS is now back in online mode.
5. Log in as usual, and now is the chance to set up your temporary database.



29.11 Online/Offline Mode Persistence

By default, GCAS Desktop assumes online mode every time it is launched. If you choose to work offline, GCAS Desktop enters offline mode until you exit the software but returns to online mode on the next time you run the software again.

You can make GCAS Desktop stay in offline mode even after you exit GCAS. To do so, open *Work Offline Preferences* dialogue through the File menu > Work Offline > **Work Offline Preferences**. Give a tick on **Remember current state (offline/online) for the next time GCAS is launched**.


Work Offline Preferences
Sync data in the temporary database from the last 12 months
Storing too much data in the temporary database will take more disk space and more time to finish a synchronisation process.
Automatically sync to central database server when I go online
Automatically switch to temporary database if network connection is lost
Resume all modbus operations after a successful switchover
Do a periodic check if GCAS can return online every 3 minutes
And if GCAS can return online,
Notify me
Automatically switch back to central database
Remember current state (offline/online) for next time GCAS is launched
OK
Cancel

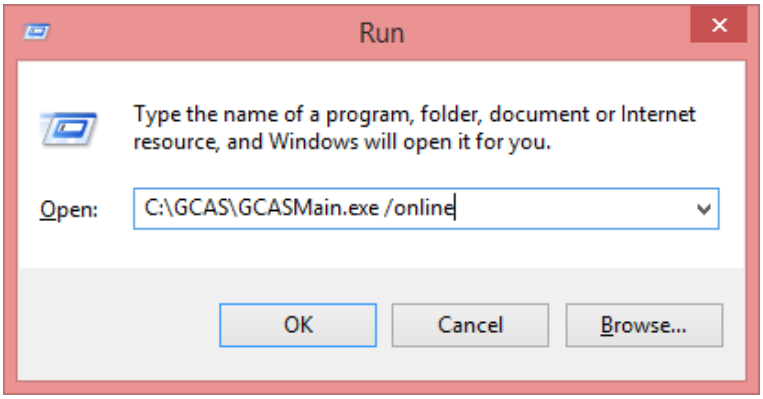
When you switch to offline mode and exit GCAS Desktop, the login form will stay in offline mode upon next time you launch GCAS Desktop.

Warning

Only users who have set up their temporary database can log in during offline mode.

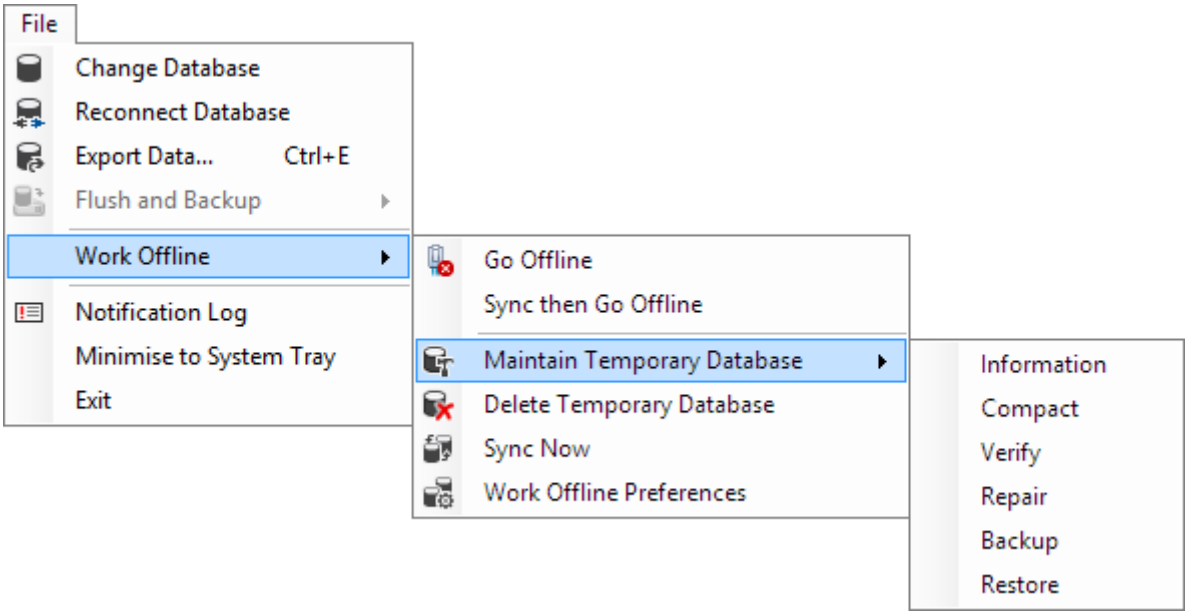
To override the initial mode, run GCAS Desktop with one of the following parameters:

- **/online** : Forces online mode.
- **/offline** : Forces offline mode.



29.12 Maintenance of Temporary Database

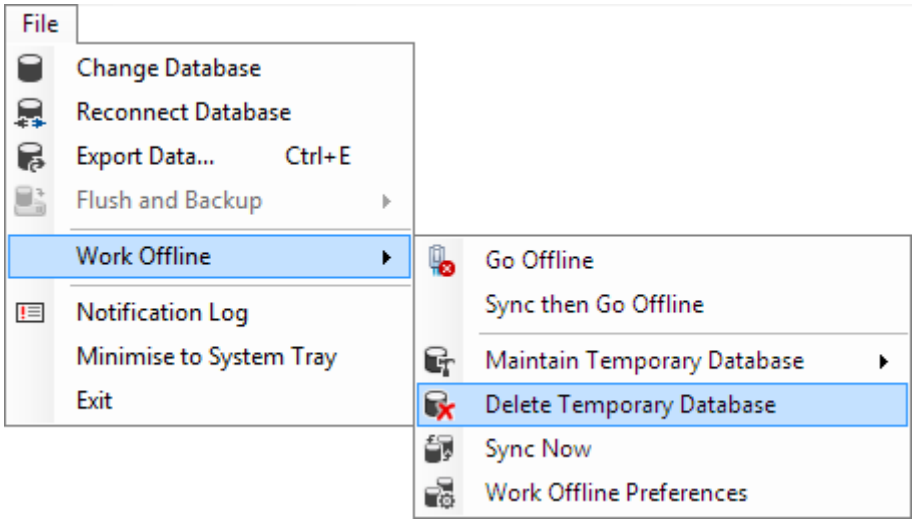
To perform maintenance, you need to go online. Then open the File menu > Work Offline > **Maintain Temporary Database**. It contains all submenus to perform database maintenance.



Menu	**What it does**
Information	Displays the size of your temporary database file, how much data stored in it (i.e. the timestamp of the earliest data available), and also the date and time of last sync operation.
Compact	Tries to shrink the size of your temporary database file by consolidating sparse free spaces similar to defragmenting a hard disk.
Verify	Uses the built-in verification feature on Microsoft SQL Server Compact Edition in order to check that all tables and indexes are not corrupt. If verification result says the database is corrupted, try the **Repair** menu.
Repair	Should the **Verify** menu reported a problem on your temporary database, this menu attempts to repair the file.
Backup	Makes a backup copy of your temporary database. To restore from this backup, use the **Restore** menu. Otherwise if you have deleted your temporary database, go to chapter 29.1.2 Restore a Backup to reuse this backup file.
Restore	Replaces your current temporary database with a backup.

29.13 Deactivate Offline Working

To deactivate this work-offline feature, you need to go online. It is a good idea to synchronise your main database server with your temporary database for the last time, in order to make sure there are no pending data in your temporary database which have not been synchronised to your database server. Then, open the File menu > Work Offline > **Delete Temporary Database**.



This will delete your temporary database file. You cannot work offline until you set up a new temporary database or open an existing backup.

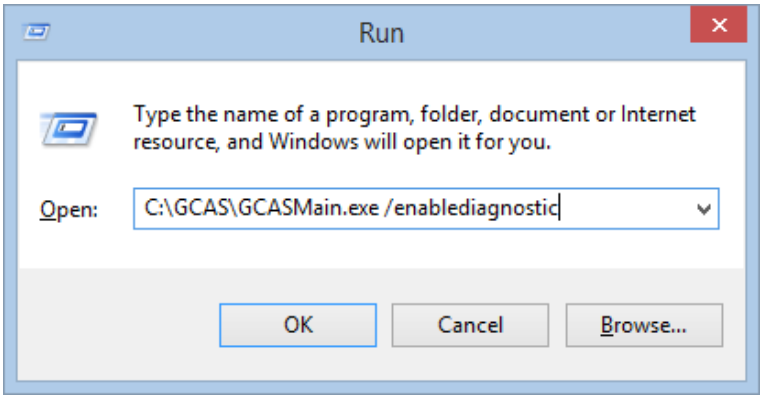
30 Diagnostic and Maintenance

This chapter attempts to assist you in case of errors and malfunctions of GCAS Desktop.

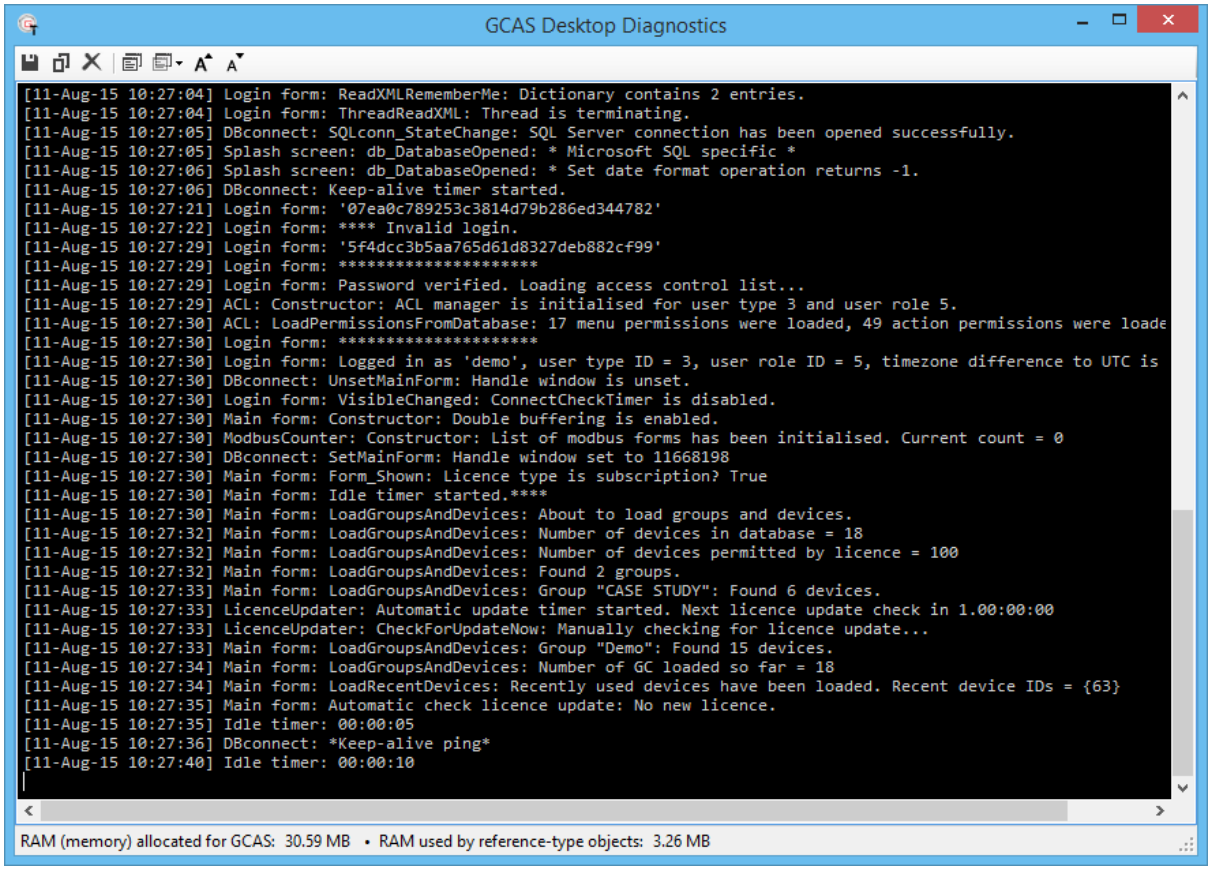
30.1 Diagnostic Mode

On a rare occasions of malfunctions such as exceptions, unhandled exceptions, crashes, or wrong calculations, you can run GCAS Desktop in *diagnostic mode* to collect additional information about the reason for the malfunction to happen. On diagnostic mode, GCAS Desktop displays an additional window that acts like a debugger output window. When you report a bug to us, this diagnostic log helps us a lot in order to resolve the problem.

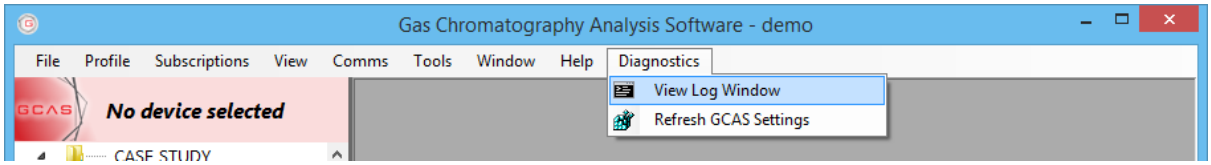
Start GCAS Desktop with an additional parameter **/enablediagnostic** to activate diagnostic mode. Formerly it was "/enablediagnostics" (with an incorrect "s" at the end of word), now it is "/enablediagnostic".



The diagnostic window looks like a console. GCAS Desktop runs normally alongside this window and you can use the software as usual.


GCAS Desktop Diagnostics
[11-Aug-15 10:27:04] Login form: ReadXMLRememberMe: Dictionary contains 2 entries.
[11-Aug-15 10:27:04] Login form: ThreadReadXML: Thread is terminating.
[11-Aug-15 10:27:05] DBconnect: SQLconn_StateChange: SQL Server connection has been opened successfully.
[11-Aug-15 10:27:05] Splash screen: db_DatabaseOpened: * Microsoft SQL specific *
[11-Aug-15 10:27:06] Splash screen: db_DatabaseOpened: * Set date format operation returns -1.
[11-Aug-15 10:27:06] DBconnect: Keep-alive timer started.
[11-Aug-15 10:27:21] Login form: '07ea0c789253c3814d79b286ed344782'
[11-Aug-15 10:27:22] Login form: **** Invalid login.
[11-Aug-15 10:27:29] Login form: '5f4dcc3b5aa765d61d8327deb882cf99'
[11-Aug-15 10:27:29] Login form: **********
[11-Aug-15 10:27:29] Login form: Password verified. Loading access control list...
[11-Aug-15 10:27:29] ACL: Constructor: ACL manager is initialised for user type 3 and user role 5.
[11-Aug-15 10:27:30] ACL: LoadPermissionsFromDatabase: 17 menu permissions were loaded, 49 action permissions were loade
[11-Aug-15 10:27:30] Login form: **********
[11-Aug-15 10:27:30] Login form: Logged in as 'demo', user type ID = 3, user role ID = 5, timezone difference to UTC is
[11-Aug-15 10:27:30] DBconnect: UnsetMainForm: Handle window is unset.
[11-Aug-15 10:27:30] Login form: VisibleChanged: ConnectCheckTimer is disabled.
[11-Aug-15 10:27:30] Main form: Constructor: Double buffering is enabled.
[11-Aug-15 10:27:30] ModbusCounter: Constructor: List of modbus forms has been initialised. Current count = 0
[11-Aug-15 10:27:30] DBconnect: SetMainForm: Handle window set to 11668198
[11-Aug-15 10:27:30] Main form: Form_Shown: Licence type is subscription? True
[11-Aug-15 10:27:30] Main form: Idle timer started.****
[11-Aug-15 10:27:30] Main form: LoadGroupsAndDevices: About to load groups and devices.
[11-Aug-15 10:27:32] Main form: LoadGroupsAndDevices: Number of devices in database = 18
[11-Aug-15 10:27:32] Main form: LoadGroupsAndDevices: Number of devices permitted by licence = 100
[11-Aug-15 10:27:32] Main form: LoadGroupsAndDevices: Found 2 groups.
[11-Aug-15 10:27:33] Main form: LoadGroupsAndDevices: Group "CASE STUDY": Found 6 devices.
[11-Aug-15 10:27:33] LicenceUpdater: Automatic update timer started. Next licence update check in 1.00:00:00
[11-Aug-15 10:27:33] LicenceUpdater: CheckForUpdateNow: Manually checking for licence update...
[11-Aug-15 10:27:33] Main form: LoadGroupsAndDevices: Group "Demo": Found 15 devices.
[11-Aug-15 10:27:34] Main form: LoadGroupsAndDevices: Number of GC loaded so far = 18
[11-Aug-15 10:27:34] Main form: LoadRecentDevices: Recently used devices have been loaded. Recent device IDs = {63}
[11-Aug-15 10:27:35] Main form: Automatic check licence update: No new licence.
[11-Aug-15 10:27:35] Idle timer: 00:00:05
[11-Aug-15 10:27:36] DBconnect: *Keep-alive ping*
[11-Aug-15 10:27:40] Idle timer: 00:00:10
RAM (memory) allocated for GCAS: 30.59 MB • RAM used by reference-type objects: 3.26 MB

You can minimise or close the diagnostic window at any time. The diagnostic window continues to output debug information even after it is closed. To show the window again, go to the Diagnostics menu > **View Log Window**.



To save the diagnostic information, use the **Save** button on the toolbar. Alternatively you can copy the contents through the **Copy** button then paste it onto notepad or any text editor.

Info

If GCAS Desktop crashed, it might not be possible to use the Save or Copy button on the toolbar because the user interface is frozen (white-shadowed) by Windows operating system. A screenshot of this frozen diagnostic window should suffice to help us understanding what the reason and at which point the error happened.

30.2 What Happened to Bug Report Wizard?

Unfortunately we disabled Bug Report Wizard due to policy changes of our mail provider. In the past, Bug Report Wizard worked by sending your report and all additional attachments (diagnostic log and

optional screenshots) via email to our development team behind the screen. However our mail provider didn't seem happy and made few changes in their terms of use. For that reason, we need to temporarily disable the Bug Report Wizard until we developed a new reporting mechanism which doesn't involve SMTP (email). Bug Report Wizard has disappeared since GCAS Desktop version 1.7.2.0.

For the time being, please send your bug report with any additional attachments such as diagnostic log, stack trace, or screenshots to support@i-Vigilant.com.

31 GCAS Startup Parameters

Startup parameters are optional arguments used to run GCAS Desktop or GCAS Activator, with the intention to enable or disable some advanced functionality.

Below are the list of additional start up parameters for GCAS Desktop (`GCASMain.exe`).

/changedatabase	:	Displays the Change Database dialogue only. GCAS Desktop terminates immediately after you click the **OK** button. This parameter cannot be combined with any other parameters.
/online	:	Forces online mode. Cannot be combined with **/offline** switch.
/offline	:	Forces offline mode. Cannot be combined with **/online** switch. Only users who have set up their temporary database can log in to GCAS.
/disablefilecheck	:	Disables the integrity check during startup. GCAS Desktop will not check the files inside the installation directory for any unauthorised changes.
/disablekeepalive	:	Turns off the database ping timer. Database ping timer sends a ping to your database server once every 30 seconds. This is because some database servers disconnect the client if there were no activity for a certain interval. By running GCAS Desktop with this parameter, ping timer will not run and GCAS database server may terminate your connection for extended period of inactivity.
/disableexcel	:	Disables the Microsoft Office interop module. That is, Export Data to Excel won't be available, *Copy to Excel* button on the Comments form will be greyed out, *Export Values to Excel* button on the Mole Composition Comparison form will be disabled, *Export to Excel* button on MLC offline converter tools will be unavailable, and pretty much everything that exports directly to Microsoft Excel. Use this switch if you see "COM exception" continuously every time you use features related to Microsoft Excel.
/enablediagnostic	:	Activates the diagnostic mode.
/confirmimport	:	Causes GCAS Desktop to display a confirmation dialog whenever you import a footprint or calibration data from a text file. Clicking **Cancel** on the confirmation dialog will abort the import process.

/modbusbase:X : Translates the base register address from the default `0` (zero) to any number you have specified. There is a colon (`:`) between "modbusbase" and the number, but there must not be any spaces between modbusbase, the colon, and the number.

For example, **/modbusbase:40000** specifies base address `40000` instead of `0`. This switch is only used for certain GC devices and on specific circumstances.

/disablecalibrationcache : By default, whenever you open GC Connect form, the latest RF and RT data for that device is cached. If the first poll returns the exact same RF and RT data, this incoming record is not regarded as a new data, thus GCAS Desktop avoids duplicated RF/RT data.

This switch disables the caching behaviour. If you run GCAS Desktop with /disablecalibrationcache, latest RF/RT data is not cached during the launch of GC Connect form.

/drawincompleteRFRT : If GCAS Desktop was instructed to ignore RF or RT data during data capture, GCAS Desktop assigns a special value −1 to all RF or RT values. This −1 value is not drawn on Data Analysis form. Using this switch overrides the behaviour; −1 values are always graphed.

/disabledoublebuffering : Disables double buffering on your graphic card when rendering GCAS Desktop main form. Use this switch if you experience display problem or performance drop when using GCAS Desktop.

/drawemptyUT : Forces GCAS to reveal empty points in Uncertainty Trend chart.

Empty points are data points that only has X value, without Y value or its Y value is undefined. Example of empty points is when you set the uncertainty trend in forward direction and the minimum number of data is 10, then the first 9 calibration data after a footprint are marked as *empty* (hence is not drawn on the chart and you see a gap).

With **/drawemptyUT**, GCAS Desktop draws grey dots for empty points. The X values of these grey dots are valid (correspond to dates and times on X-axis correctly), but their Y values are meaningless.

/disableUTcache : Disables cache in the Uncertainty Trend module. GCAS Desktop caches the calibration certificate and footprint reference while calculating uncertainty values. Disabling the cache means GCAS Desktop will always retrieve the footprint and certificate values from database. This makes calculation time becomes longer.

/excludefootprintUT	:	Forces GCAS Desktop to exclude the last footprint while calculating uncertainty values in Uncertainty Trend module. On normal forward calculation, the data included to calculate the uncertainty at one point is taken from the last footprint (including the footprint itself) up to this point. This switch causes GCAS to exclude that last footprint, so data range starts from one calibration after the footprint. On normal backward calculation, the data included to calculate the uncertainty at one point is taken from that point and travels backward. If you set GCAS to trim at footprint, the last footprint is included in the calculation but it stops (hence the footprint is the *last* data). With **/excludefootprintUT**, GCAS stops at one calibration after the footprint. Nevertheless, if you set GCAS to continue through (include data before footprint) then this switch has no effect.
/UTdiagnostic	:	Activates the Uncertainty Trend diagnostic.

Additionally, these are a list of advanced start-up parameters for GCAS Activator (`GCASActivate.exe`).

/?	:	Displays a quick help in a console window or a message box.
/info	:	Displays the details of the licence and registration key installed on your computer.
/compcode	:	Displays the computer code of your computer.
/install <licence string>	:	Installs the specified GCAS licence, or replaces currently installed licence with a new one. Cannot be combined with **/revoke** parameter. Recommended to combine **/install** with **/regkey** parameter so that you install the licence and registration key in one go.
/regkey <6-digit registration key>	:	Installs the specified registration key, or replaces current registration key with a new one. Cannot be combined with **/revoke** parameter.
/revoke	:	Uninstalls the current licence and registration key from your computer. Cannot be combined with **/install** nor **/regkey**. Deactivating your GCAS Desktop software does not automatically increase your activation count in case you bought licences for multiple computers. Contact us to migrate your licence along with

attaching the screenshot of command prompt window as a proof of deactivation.

/silent : Do not display any message boxes or confirmation messages. Combine this switch with **/install**, **/regkey**, or **/revoke**.

Note

GCAS Activator (`GCASActivate.exe`) requires elevation. Run `GCASActivate.exe` on an elevated command prompt (run as administrator) to use the commands above.

End of Document